THE IMPACT OF INFORMATION AND COMMUNICATIONS TECHNOLOGY ON AUDITING

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ABSTRACT

The role currently being played by Information and Communications Technology (ICT) in ensuring the accuracy, timeliness and integrity of audit reports cannot be stressed too strongly. This thesis, relates to a study on assessing the current and potential impact of ICT on auditing in providing useful information for a wide range of users.

Using a triangulation of interview and questionnaire techniques, the study covers the activities of auditors working in the "big4" accounting firms, some small and medium sized accounting firms, one of the UK's "big7" banks and some government agencies. This exploratory study is privileged to be one of the first to shed more light on the current state of affairs regarding the extent of use of ICT tools and techniques by both internal and external auditors. Also, the study has been able to assess the impact these tools and techniques are currently having on auditors and the organisations they work for by identifying the main benefits and drawbacks ICT has brought to the profession. As a result of its findings, this research is able to identify and discuss potential areas of the audit profession that could benefit from further utilisation of ICT.

This study is the first to empirically assess the current and potential use of Continuous Online Auditing within the UK auditing profession comprising both public and commercial establishments. Similarly, the study is able to break new ground in accounting research by exploring the impact audit automation is having on auditor independence and the audit expectations-performance gap. Above all, the production of a three-layered model (an integration of contingency, socio-technical systems and structuration theories) for a comprehensive understanding of ICT impact on audit remains a major highlight of the study. The model advocates that *the use of ICT in audits is a function of certain contingent factors that determine an optimal mix of human skills and technological capabilities, which would lead to changes in the nature of auditors' roles and outputs and audit organisations' structures.*

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ACL	Audit Command Language
AEG	Audit Expectations-Performance Gap
ALFEX	Alvey Financial Expert System
CAATT	Computer-Assisted Auditing Tools and Techniques
CCAB	Consultative Committee of Accountancy Bodies (UK)
CFR	Corporate Financial Reporting
CIOV	Continuous Intelligent Online Validation
CIS	Computerised Information Systems
COA	Continuous Online Auditing
COBIT	Control Objectives for Information and Related Technology
COSO	Committee of Sponsoring Organisations of the Treadway Commission
CSF	Critical Success Factor
CTO	Contingency Theory of Organisation
DEA	Data Envelopment Analysis
DSS	Decision Support System
EAM	Embedded Audit Module
EDGAR	Electronic Data Gathering Analysis and Retrieval
EDI	Electronic Data Interchange
EDP	Electronic Data Processing
EFT	Electronic File Transfer
ERP	Enterprise Resource Planning
ES	Expert System
GSS	Group Support System
HTML	Hypertext Mark-Up Language
ICAEW	Institute of Chartered Accountants in England and Wales
ICT	Information and Communications Technology
IDEA	Interactive Data Extraction and Analysis
IS	Information System
IT	Information Technology
KBES	Knowledge-Based Expert System

RTA	Real Time Accounting
SCARF	Systems Control and Audit Review Facility
SPSS	The Statistical Package for Social Sciences
TQM	Total Quality Management
WAS	Weighted Average Score
XBRL	Extensible Business Reporting Language
XML	Extensible Mark-Up Language

CHAPTER ONE

INTRODUCTION AND BACKGROUND TO THE STUDY

1.0: Introduction

This chapter's main purpose is to build a general background for the study. This is carried out by discussing what auditing means in relation to the study's purpose and significance. The chapter also maps the main objectives of the study to justify its relevance and contribution towards moving forward the frontiers of knowledge in the area of audit automation. In addition, the chapter highlights the scope of the study in terms of coverage thereby setting the ground for what the subsequent chapters will contain.

1.1.0: Background to the Study

The practice of formalised auditing as a professional field of accountancy can be traced back to the closing years of the 19th century when professional accounting bodies were founded in several countries and governments began to make audit compulsory as a way of protecting the interests of shareholders. In the 19th and early 20th centuries, the central theme of auditing was about providing an independent third party opinion on the financial statements of an entity and confirming that the balance sheet was not fraudulently stated while in the latter part of the 20th century and early 21st century, the (external) audit report has come to be seen as an expert opinion on the quality and compliance of financial information with required accounting standards and company legislation (Cosserat, 2004).

An audit is an examination of the evidence upon which the financial statements of an establishment are based as an independent task, to generate an opinion as to whether the financial statements represent a 'true and fair view' and have been prepared in accordance with the applicable reporting framework.

While the foregoing relates to what is generally referred to as external audit, the other form of audit (based on primary beneficiaries), internal audit, is "an appraisal or monitoring activity established by management and directors, for the review of the accounting and internal control systems as a service to the entity. It functions by, amongst other things, examining, evaluating and reporting to management and the directors on the adequacy and effectiveness of components of the accounting and internal control systems" (Cosserat, 2004: 666).

An internal audit is usually conducted according to the terms set by management in the internal audit charter. It is conducted either as a continuous activity or a one-off assignment. According to Porter et al. (2003: 7), "they may, for example, be as broad as investigating the appropriateness of, and level of compliance with, the organisation's systems of internal controls, or as narrow as examining the entity's policies and procedures for ensuring compliance with health and safety regulations".

Internal audit is relatively new compared to external audit. Its role has been changing over the years due to the increased call for a better accountability and effectiveness by management of business entities with a view to guaranteeing efficient corporate governance practices while promoting operational effectiveness within the business.

Although internal audit emerged as a service to the management, its importance particularly to large organisations in ensuring good corporate governance is very significant in modern day business. This is because internal audit has a key function in guaranteeing effective internal control within an organisation thereby enabling directors to confirm that their organisations comply with the corporate governance requirement to ensure effective internal controls. In addition, the latest corporate governance report on audit committees (Smith Report, 2003) stipulates that internal auditors should be responsible to the audit committee rather than the

management to ensure independence and effectiveness (see pages 13 - 14 in chapter two for the discussion of similarities and differences between external audit and internal audit).

The above descriptions of external and internal audits notwithstanding, both forms of audit are underpinned by a systematic examination and evaluation of evidence to arrive at certain conclusions that are usually presented in the form of reports. For the purpose of this study, therefore, auditing is taken as a composite profession for assurance encompassing both external and internal audits (including their off-shoots such as fraud investigation, operational audit, compliance audit and information systems audit).

Alles et al. (2002) observed that the three main components in the process of providing assurance are: capture by the auditee of the information related to the transactions, processes and environment that are the subjects of assurance; monitoring and analysis by an independent auditor of the transactions, processes and records made by the auditee to ensure the reliability of the information; and communication by the auditor on the outcome of the assurance engagement.

Auditing is an information-intensive activity involving gathering, organising, processing, evaluating and presenting data while the ultimate essence of the auditing process is to generate reliable information (in the audit report) as to the truth and fairness of the financial statements (and their compliance with the required standards and legislation) to the shareholders and other stakeholders. The role currently being played by Information and Communications Technology (ICT) in ensuring the accuracy, timeliness and integrity of such reports cannot be stressed too strongly (Banker et al., 2002) as it is this audit report that in turn strengthens the credibility attached to the financial information being presented to a wide range of users.

Manson et al. (1998) identified two schools of thought on audit methodologies: the organic and the mechanistic. The former sees the audit as mainly a matter of the auditor's judgement based on an understanding of the particular client while the latter sees the audit mainly as a set of procedures that can be applied to any audit engagement. The latter, Manson et al. believed, is an approach more amenable to computerisation.

Furthermore, the traditional view of the accounting profession (which perceives accounting as all about routine and number-crunching exercises) is being challenged by the diffusion of organisation-wide integrated information systems. This is evident in the transferability of accounting knowledge and skills to non-accountants (functional managers) through ICT. Today, most of these routine and number-crunching tasks are taken care of by ICT while the modern accountant is being assigned new roles which include strategic decision making, business management and Enterprise Resource Planning (ERP) (Caglio, 2003).

The major aspects of auditing centre on planning, control and decision-making. While these functions require quantitative processing usually carried out employing ICT, they also require qualitative factors. The objective of an audit and the need to assess risks and understand control are not affected by the extent and nature of ICT used by an organisation. The same basic auditing standards and financial reporting objectives apply in all situations. However, the auditor must be aware of the nature of an organisation's ICT infrastructure because the design and operation of the various systems will have a direct impact on audit risk, the conduct of the audit, the evaluation of processes and the nature of audit evidence to be gathered (Knechel, 2001).

It will be a pertinent exercise to explore the individuals and groups that might feel the impact of using ICT tools and techniques in the audit processes and procedures. The entities concerned are depicted in figure 1.1.

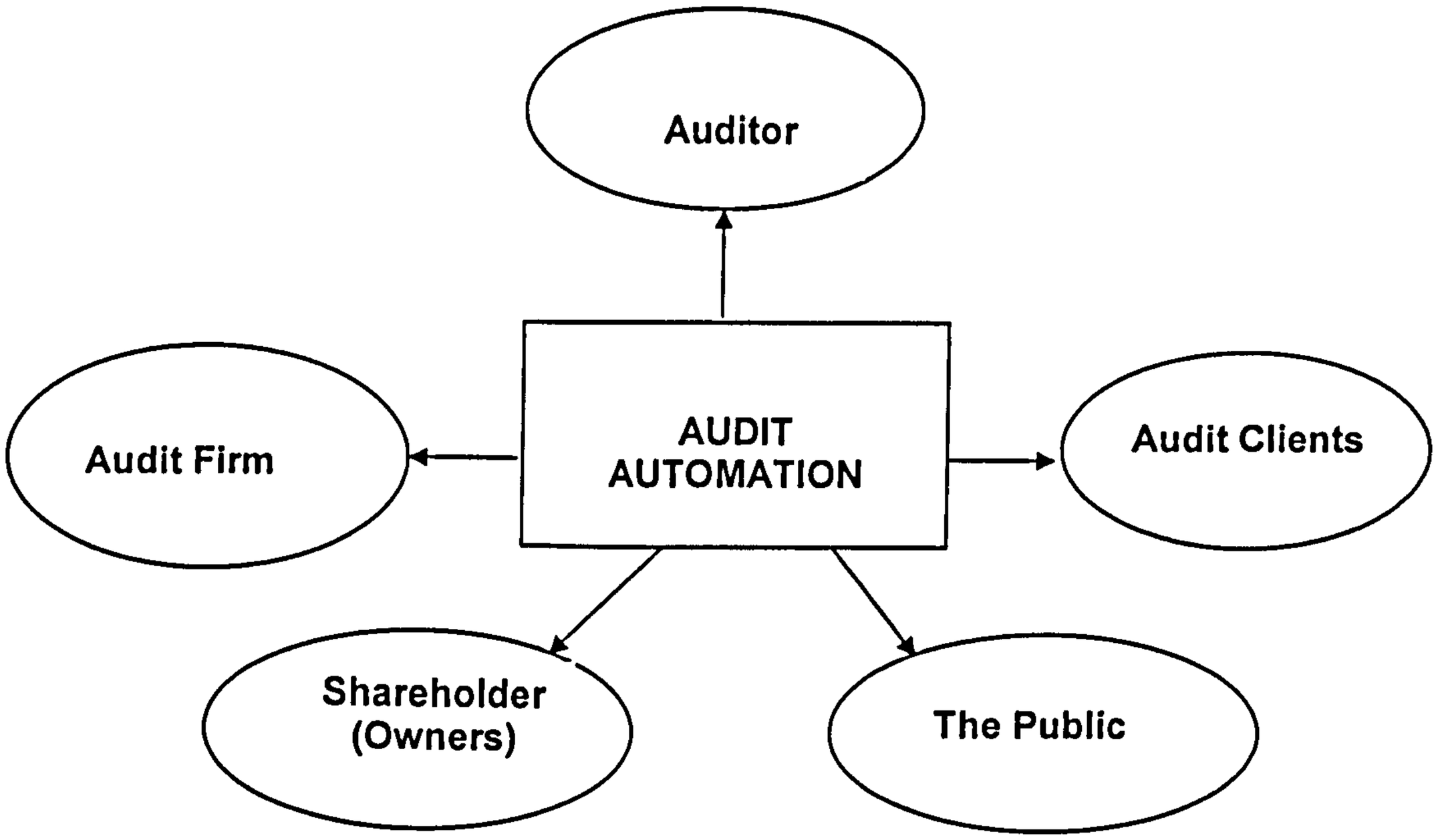


Figure 1.1: Entities Affected by ICT's Use in Audits

The five main entities, shown in the diagram, that will be affected by the upward trend in auditors' use of ICT tools and techniques are: the auditors themselves (in terms of performance, role change, attitudes and career progression); the audit firm or department (in terms of profitability as well as task and organisational restructuring); audit clients (in terms of audit fee and audit quality); shareholders (in terms of more dependable assurance) and the public (which includes other stakeholders and regulators in terms of expectations and perceptions).

These five entities affected in one way or the other by the trends in audit automation constitute the main focus of this study as demonstrated in subsequent sections of this chapter.

1.2.0: The Research Aim

The central role auditing plays in Corporate Governance puts the profession under increasing scrutiny across the world. This situation makes continuous improvement in audit practices pertinent to the profession. As developments in ICT tools and techniques continue to contribute to improvements in almost all business areas, this study is an exploratory research aimed primarily at assessing the current and potential impact of ICT on audit quality, efficiency and effectiveness.

Figure 1.2 shows the structure of the research process depicting the research aim as the basis for gathering and reviewing of relevant literature as a way of identifying gaps, in terms of deficiencies or limitations, which currently exist in the literature with a view to formulating appropriate research objectives. These objectives were expressed as research propositions for which the research instruments were designed to collect data. The data was analysed to obtain key findings and led to the emergence of the three-layered model.

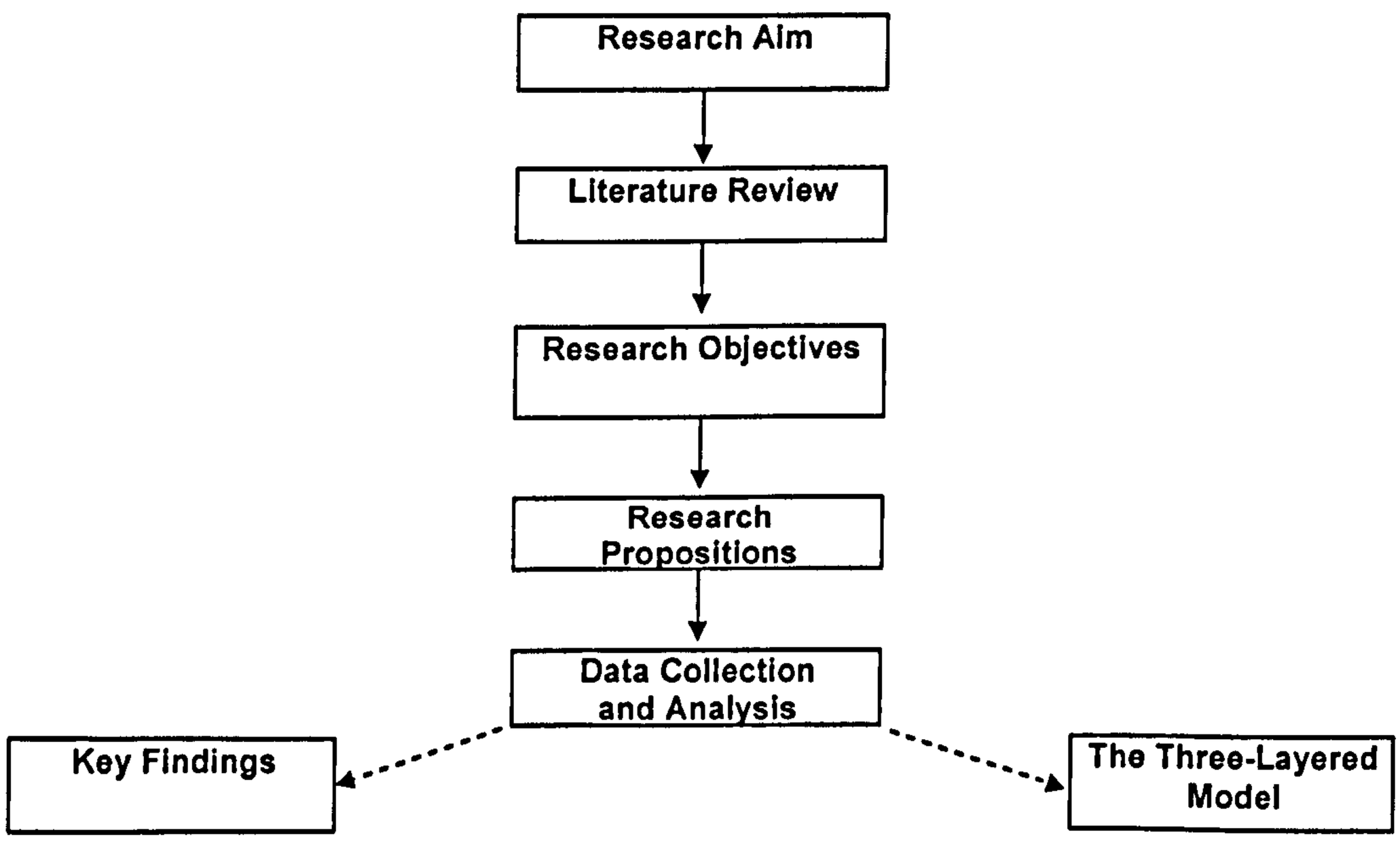


Fig. 1.2: Structure of the Research Process

1.3.0: Main Objectives of the Study

Based on the research aim and the gaps identified in the literature as discussed in chapter two (pages 99 to 107), the following objectives were adopted:

i. Identifying the current and potential relationship that may exist between ICT and Auditing
ii. Assessing the roles ICT plays in restructuring audit firms/departments as well as auditors' roles and responsibilities
iii. Examining the relative usefulness of ICT to auditing with respect to certain contingent factors
iv. Assessing the current state of Continuous Online Auditing's (COA) use and its potential for auditing and financial reporting
v. Examining the part ICT plays in the debate on auditor independence
vi. Assessing the role ICT plays in reducing the Audit Expectations-Performance Gap
vii. Identifying a suitable theoretical framework applicable to studying ICT's impact on auditing.

These research objectives were further translated into propositions that could be evaluated through the collection and analysis of data:

Current Implications of ICT for Auditing

i. ICT has had a positive impact on auditing
ii. Auditors' use of ICT tools and techniques renders manual techniques obsolete
iii. The extent of ICT utilisation for audit assignments is affected by audit firms' and clients' size, nature of audit tasks and auditors' experience

Future Direction of ICT Impact on Auditing

iv. ICT does have potential ways of impacting on auditing
v. Audit automation affects the structure of an organisation
vi. COA could be considered the future of auditing
vii. Audit automation impacts on auditor independence
viii. Audit automation impacts on the Audit Expectations-Performance Gap

1.4.0: Scope of the Study

This study covers the activities of both external and internal auditors working in the public as well as private sectors of the economy. All the "big4" accounting firms (comprising Deloitte and Touche, Ernst and Young, KPMG and PricewaterhouseCoopers), some small and medium sized accounting firms, one of the UK's "big7" banks and some government agencies participated in the study. The choice of this diverse range of organisations is to enable the research to cover both the private and the public sectors of the economy. In all, seventy-four auditors from thirty-six organisations participated in the study.

1.5.0: Significance of the Study

The foregoing expositions and perspectives on the use of ICT in audits are useful in understanding the complexities of modern day audit. Many audit firms, particularly the large ones, in addition to using high-tech tools and techniques in their audit tasks, provide consultancy services in the area of the computerisation of their clients' accounting systems in terms of design, implementation and maintenance. This study therefore explores what impact the use of these tools and techniques by auditors is likely to have on auditor independence as ICT-based concepts such as Embedded Audit Modules and Continuous Online Auditing link the auditors' systems with those of their clients through computerised telecommunication devices.

While other branches of accounting such as management accounting and financial accounting have been the main focus of ICT's impact as far back as the early 1980s, studies on ICT-Audit were not noticeable until one and a half decades ago. Many of these previous works concentrated on developing the concepts of and models for Audit Automation (Lenard et al., 1995; Murphy, 1990; Van den Acker, 1999) and Continuous Online Auditing (Kogan et al., 1999; Rezaee et al., 2002) while others either focused on rationalising and discussing the effects ICT has had on certain aspects of auditing or used a single theoretical model/narrow methodological framework (Eining et al., 1997; Yu et al., 2000; Swinney, 1999; Manson et al., 2001; Abdolmohammadi and Usoff, 2001).

However, this piece of research attempts to fill some of the current gaps in the literature on ICT-Audit through the lens of a three-layered model comprising the contingency, socio-technical systems and structuration theories (as suggested respectively by Xiao et al., 1996 Orlikowski, 1992 and Manson et al., 2001). Besides, the study is able to break new ground by starting the investigation into ICT's impact on the Audit Expectations-Performance Gap and auditor independence.

Assessing the impact of ICT on financial statements audit goes beyond the simplistic approach of a mere random selection of some audit firms as research subjects. Such an endeavour requires an in-depth research as the work setting and organisational contexts surrounding the application of ICT might be lost to some forms of generalisations rather than carefully considering the peculiar nature of each organisation's size, industry, location, policies, audit procedures, tasks and environment. This is best underpinned by the contingency theory of organisations (CTO). The earlier works reviewed in section 2.2 (chapter two) cannot sufficiently describe the current trends in the use of ICT tools and techniques in relation to these contingent factors. Hence, this study is able to fill these gaps and go a step further by predicting the future direction of such auditing tools and techniques.

Lastly, there is evidence of ICT introduction affecting the organisational structures of audit firms and departments from the literature (for example, Manson et al., 2001 and Caglio, 2003). This study investigates this further through a triangulation approach of combining qualitative and quantitative methodologies across a variety of organisations and the results indicate that ICT and human actors do dictate the pace for each other and the two continue to restructure the roles and responsibilities obtainable in any audit organisation vis-à-vis human-technology interaction. This is further strengthened by the socio-technical system perspectives.

This study attempts to be the first to discuss ICT's impact on auditing using a combination of three theoretical perspectives of contingency, socio-technical systems and structuration theories together. The application of these three frameworks is a new approach in auditing research. These three frameworks were identified at the beginning of the study as being independent and it was a key objective of the study to explore them in the light of the data gathered in order to determine their relevance and the relative importance of each framework to the study of ICT's impact on auditing. However, the analysis of the data showed that the three theories are indeed interconnected in a step-wise form, hence, the production of the three-layered model which stands as a major contribution of the study.

The model proposes that the use of ICT in audits is a function of certain contingent factors (nature of the audit, size of the firm/client and auditor's experience) that determine an optimal mix of human skills and technological capabilities, which would lead to changes in auditors' roles and outputs, audit organisations' structures and the structure of the audit profession. Furthermore, the study's results indicate that although there is a steady upward growth in auditors' use of ICT tools and techniques, the number of junior auditors continues to shrink as a direct consequence of this trend. This might imply that sufficient numbers of

experienced auditors might be lacking in the not too distant future. However, the increase in the number of specialised auditors (such as IS auditors) coupled with the developments in artificial intelligence suggests that ICT is likely to continue to create opportunities for a new-breed of auditors with specialised ICT skills.

Finally, the study suggests new areas of audit that might benefit from further utilisation of ICT in general. Added to these, the study is important as it is the first in the UK to empirically assess the current and potential use and impact of COA on the audit profession.

1.6.0: Conclusion

This chapter introduced the subject matter of the thesis, the impact of ICT on auditing. It provided a background to the subject and discussed the objectives and significance of the study. It also discussed the main contributions of the study in relation to the existing literature in the area of audit automation. The remainder of the thesis contains a review of literature and relevant theories (chapter two); research methodology (chapter three); data analysis and discussion of the current implications of ICT for auditing (chapter four); data analysis and discussion on the future directions of ICT's impact on auditing (chapter five); the fusion of the three theoretical frameworks for the study into a three-layered model (chapter six) and conclusions, recommendations and implications for further research (chapter seven).

CHAPTER TWO

A REVIEW OF LITERATURE AND THEORIES

2.0: Introduction

The first chapter provided a general background for the study while this current chapter expounds relevant auditing themes including developments in auditor independence and the audit expectations-performance gap as they may relate to the use of ICT. It also traces the trend in the use of information and communications technology (ICT) in business operations and the challenges this trend poses for accounting information systems in general and its concomitant current and future implications for auditing and assurance services. The chapter goes further to review existing literature in the areas of audit automation, computer-assisted auditing tools and techniques, decision aids in auditing (comprising decision support systems, neural networks and knowledge-based expert systems) and continuous online auditing.

In addition, the chapter provides an overview of the intended theoretical frameworks for this research. These are the contingency, socio-technical systems and structuration theories. Above all, the chapter discusses how the research propositions were drawn from the literature.

2.1.0: Auditing in Perspective

According to the American Accounting Association (AAA) (1973) as quoted in Porter et al., (2003:3):

"Auditing is a systematic process of objectively gathering and evaluating evidence relating to assertions about economic actions and events in which the individual or organisation making the assertions has been engaged, to ascertain the degree of correspondence between those assertions and established criteria, and

communicating the results to users of the reports in which the assertions are made".

According to the primary beneficiaries, audits can be categorised into external and internal. An external audit is where independent experts carry out an audit for the benefit of parties external to the audited entity (e.g. a statutory audit) while an internal audit is carried out by either employees of an entity or contracted personnel (if outsourced to, say, accounting firms) for the benefit of the entity's management as defined by them (the management). An example of internal audit's focus includes investigating the appropriateness and effectiveness of an entity's internal control systems (Porter et al., 2003).

The following represents the key areas of difference between external and internal audits:

	External Audit	Internal Audit
Independence	Independent of entity	Employed by management
Responsibilities	Fixed by relevant statutes	Decided by management/ Directors
Report to	Members/ owners	Management/Directors
Scope of work	Express an opinion on truth and fairness of accounts .	Consider whatever financial and operational areas management decides

Table 2.1: Differences Between External and Internal Audits

In spite of the above categorisation of audit, Porter et al. (2003: 8) stressed that *"although different categories and types of audit may be recognised, all audits possess the same general characteristics..."*

- *the systematic examination and evaluation of evidence which is undertaken to ascertain whether statements or actions by individuals or organisations comply with established criteria; and*
- *communication of the results of the examination, usually in a written report, to the party by whom, or on whose behalf, the auditor was appointed."*

Furthermore, SAS 500 stipulates that external auditors must obtain a sufficient understanding of the work carried out by internal auditors to help in the planning and development of an effective audit approach and to reach a conclusion on the possibility and the desirability of relying on the internal auditors' work. This forges a form of mutual cooperation in the work of the internal and external auditors. Such cooperation would further enhance effective and efficient corporate governance (Rezaee, 2003).

2.1.1: Auditor Independence

The role of today's auditor (particularly the external auditor) has grown beyond performing just the traditional attest function into assurance services (which include risk assessment, systems reliability and entity performance measurement services) for quality enhancement. This is why there is always a form of pressure on auditors as well as the regulatory framework underlying their operations whenever an audited entity suddenly collapses (Porter, 1997). The collapse of Enron and the subsequent demise of Arthur Andersen have heightened the agitation for an answer to the question: "How come the audit is not effective enough to pre-empt these imminent problems?"

While some studies' perspective on this question is that the inability of the auditors to qualify their reports is not necessarily as a result of their incompetence but due to their reluctance to do so (for fear of litigation by the entity's creditors and the subsequent negative effect on the auditor's reputation) until the non-quantifiable

contingencies have been made manifest in the financial statements (Kida, 1980; Menon and Shwartz, 1987; Barnes and Huan, 1993), others are of the belief that it is as a result of the economic benefit being derived from the growing range of both audit as well as non-audit professional services rendered by the auditors (De Angelo, 1981; Sharma and Sidhu, 2001).

However, a survey of the literature on auditor independence and auditors' provision of non-audit services sponsored by the Institute of Chartered Accountants in England and Wales in 2002 revealed that it is a difficult task to prove that these services affect auditor independence as indirect measures are often used to assess this problem and the validity of these measures can sometimes be questionable (Beattie and Fearnley, 2000). Closely related to this is the dearth of publicly available data to buttress the argument even though it might be reasonable to conclude that the joint provision of both services adversely affects perceptions of auditor independence (Beattie, Fearnley and Brandt, 2002).

Furthermore, the growth of these services and the attendant public scepticism over the confidence in the value of audit and the reliability of the associated financial statements have led to concerted efforts in Europe and America to promote the value of the audit (Citron, 2003). These efforts, as quoted in Citron (2003: 245), include the UK's Chartered Accountants Joint Ethics Committee (1996) , the US's Independent Standards Board (1997), the International Federation of Accountants' Code of Ethics and Statement of Policy Implementation and Enforcement of Ethical Requirements (2001) and the Fédération des Experts Comptables Européans' Conceptual Approach to Protecting Auditor Independence (2001) (Citron, 2003).

Efforts are equally being made by various governments across the globe to ensure auditor independence so as to be able to enhance the credibility of financial reports. In the UK and Australia, legislation requires that auditors disclose the level of fees for non-audit services so that interested parties can assess auditors' level

of reliance on their clients for income and the consequent independence implications. In Italy, the provision of non-audit services to audit clients is outlawed while strict restrictions are being implemented in France, Germany and The Netherlands (Sharma and Sidhu, 2001).

Auditor independence requires that auditors should exhibit intellectual honesty and judicial impartiality in addition to professional competence in the course of their work for them to be fair to the shareholders of a business entity as these qualities will add some degree of reliability to and confidence in the reports they issue. Ordinarily, it would be expected that the computerisation of auditing should help auditors a great deal as ICT tools and techniques are unbiased and objective in relation to audit clients and their systems, and, in the context of the expectations gap, the auditor is able to examine all the transactions undertaken, not just a sample, thereby enhancing the scope of the audit and extending the testing to a much greater number of transactions. However, Perks (1993) argued that as long as auditors are constrained by the concern for fee income and client retention, while these matters are to a large extent still within the hands of the management, the possibility of true auditor independence is remote.

A corollary of the above is contained in the work of Beattie and Fearnley (1998) which indicated that auditor appointment is effectively in the hands of the management and not at the discretion of the shareholders as the law requires since management can bring pressure to bear on auditors and their judgements and hold the threat of their removal over them to gain the upper hand in the relationship. This practice poses a significant threat to auditor independence of thought and action. Again, the question that needs be answered therefore is: will the use of ICT and COA help restore objectivity to the audit process and help to counter the perceived threats to independence? This constitutes one core area this research aims to shed more light upon.

Similarly, Moizer (1997) explained the reality of auditor independence in the light of ethical reasoning and economic analysis. The former relates to the auditor producing dishonest reports due to the consideration of the consequences an honest report would have on the entity and society in general as well as the auditor's future well being, while the latter relates to the auditor being a rational economic being therefore doing everything possible to maximise returns in terms of fee income and increasing the client base even if that warrants sometimes acting dishonestly in terms of audit judgement.

2.1.2: The Audit Expectations-Performance Gap

The Audit Expectations-Performance Gap involves the perception gap between the views of the users of audited financial statements (shareholders, creditors, suppliers, financial advisers, underwriters, regulators, lending institutions, prospective investors, employees, trade unions, government authorities and customers) as well as the wider society concerning what auditors are expected to do and what auditors believe their main duties and responsibilities are (Perks 1993). This gap has been widened further particularly within the last three decades by the increasingly sudden collapse of major multinational corporations, which had hitherto been issued with unqualified reports by their auditors prior to their demise (examples include Enron, WorldCom, Tyco International and Independent Insurance among others). As a result, auditors have been subjected to severe criticism, litigations and loss of earnings while their insurers are sometimes forced to pay huge amounts as out of court settlements to protect their clients' reputation. This situation ensues because of the erroneous perception these financial statements' users have about the role of auditors in today's business world.

Humphrey (1997) put forward the idea that the expectations gap arises from auditors' failure to detect and report fraud and errors when that is what the public expect them to do. The expectations gap thus comprises misperceptions relating to the auditor's duty regarding the detecting and reporting of fraud, detecting and

reporting company failure, the meaning of technical terms such as "true and fair view" and "present fairly", auditors' legal responsibilities and auditor independence (Humphrey, 1997).

Porter (1993) categorised the expectations gap into two aspects: the first is the gap between what society expects auditors to achieve and what they can reasonably accomplish (reasonableness gap); while the second concerns the gap between what society can reasonably expect the auditor to accomplish and what they are perceived to achieve (performance gap). She further argued that the latter comprises the deficient standards gap (the gap between the responsibilities that can reasonably be expected of auditors and auditors' existing duties as required by relevant statutes) and the deficient performance gap (the gap between the expected standard of performance of auditors' existing responsibilities and auditors' performance as perceived by society) (Porter, 1993).

Understanding the different constituents of the expectations gap better informs the application of ICT and is more likely to offer productive avenues to bridge this gap. Interestingly, the past three decades have also witnessed an unprecedented surge in the level of automation of business processes which has made it compelling for the accounting systems and procedures in such businesses to be computerised. As a result, auditors need to utilise ICT tools and techniques in improving the quality of their work and equally sharpening their ICT skills in order to be able to cope with the new challenges as the audit of the financial systems of many business organisations could no longer be carried out effectively without fully understanding the logic of computerised information processing (Omoteso et al., 2003).

In spite of the increasing use of ICT in audit processes, the central role still belongs to human judgement (Wallace, 1996), and so the professional auditing regulatory bodies and relevant government authorities are still committed to upholding the

profession's reputation and credibility by creating legal frameworks enabling auditors to give an expert, objective and independent opinion as an assurance service to the investing public.

There has been an age long controversy between financial statement users and audit regulators on the one side and audit practitioners on the other concerning the Audit Expectations-Performance Gap. While the former firmly believe that the gap will grow out of proportion if not tackled appropriately in time, the latter believe most of what constitutes the gap is based on people's ignorance of what audit is all about (Porter, 1993). Although, some of the public's expectations of the auditor could be considered a little outrageous as they are borne out of a lack of clear understanding of what statutory audit is meant to achieve (expectations under this category include interpretations of financial statements in a way to help prospective investors make investment decisions, detecting illegal acts such as fraud, auditors being responsible for the content of financial statements, auditors' reports' implication that management are reputable, competent, efficient and effective and providing absolute assurance that the figures are correct among others) yet other expectations are quite genuine and reasonable.

On the other hand, auditors cannot be insensitive or inattentive to society's expectations as it is an established fact in consumer behaviour that the stimuli in conflict with expectations receive more attention than those that conform. According to the expectancy-value model, consumers' attitudes are based on the beliefs or knowledge they have about an object or service and their evaluation of these beliefs (Hoyer and MacInnis, 1997). The onus therefore lies on the audit profession to address the communications deficiency and to correctly position itself by creating a more positive image to justify its relevance as a key function in economic processes.

It was in response to this challenge that a number of studies were carried out, Humphrey et al., (1992); Sikka et al., (1992); Anderson et al, (1993); Epstein and Geiger, (1994); Monroe and Woodliff, (1994); Lowe and Pany, (1995); Harris and Marxen, (1997); Humphrey, (1997); McEnroe and Martens, (1998); McEnroe and Martens, (2001); Porter and Gowthorpe, (2001). The McEnroe and Martens' (2001) study spanned a decade on the perceptions of audit partners and investors. Their investigation indicated that investors have higher expectations on various aspects of the audit than do auditors (particularly in the areas of disclosure, internal control, fraud and illegal operations) thus affirming that an expectations gap exists in terms of the extent of scope of the audit.

In a related study by Lowe and Pany (1993), differences in the perceptions of jurors and auditors were recorded on issues of auditors' responsibilities. Jurors perceived the auditors as a public watchdog or guardian to the extent that they expected them to search for even the smallest fraud. This suggests that there is also an expectations gap in terms of the extent of coverage by the audit.

In the view of Higson (2003:162), tackling the AEG needs to be carried out simultaneously with resolving the financial statement expectations gap as users' unrealistic expectations from financial statements may compound the problem of the AEG. These unrealistic expectations, according to Higson (2003), include the thinking that financial statements are an accurate account of an organisation's financial transactions rather than being a fair representation and that the statements must have taken care of any error or fraud that might have occurred within the year under review. The users appear to be completely oblivious of any limitations of methodologies employed to determine fair representation and their unsuitability for guaranteeing the analytical completeness and precision wished by the users.

Frantic and concerted efforts have been made by professional bodies to improve audit quality and the credibility of the audit profession by attempting to reduce the gaps through a continuous education of auditors on what their responsibilities are towards the investing public on the one hand and efforts to enlighten the investing public on what auditors are and are not responsible for on the other. Towards this end, the scope of the audit function has systematically been expanded, the curriculum of trainee accountants has been made more comprehensive and there has been increased monitoring of auditors' compliance with appropriate legislation particularly those that are put in place to reduce the gaps and the recent enlargement of the audit report to distinguish clearly the distinct responsibilities of the auditors from those of the management concerning the audited financial statements (Porter, 1993; Omoteso et al., 2003).

This is further evidenced in the establishment of certain structures and policies such as the Public Oversight Board (US), the Joint Monitoring Unit (UK), the Accountancy Foundation (UK), mandatory professional education for auditors as institutionalised by various professional accountancy bodies for their members and the issuance of new auditing standards in many countries. These include the US's SAS 59 (AICPA 1989), the UK's SAS 130 (APB 1996), Australian AUS 708 (AASB 1996) and New Zealand's AG 9 (NZSA, 1986), US's COSO (1992) and Sarbanes-Oxley Act (2002), Canadian CoCo (1995) and the UK's Combined Codes (1998) all focusing on the auditors' consideration of an entity's ability to carry on as a going concern and corporate governance requirements, a major component of the expectations gap as auditors were hitherto not required to search for indicators of going concern problems. However, in spite of these new standards, the manner in which the auditor should treat going concern problems is still a subject of controversy particularly when the entity concerned has made adequate presentation and disclosure in its financial statements (Goodman et al., 2002).

However, government authorities are obviously compelled to intervene in the issues surrounding the expectations gap. It is felt even more necessary as the self-regulating professional bodies are entangled in the dual responsibility of meeting public expectations while at the same time protecting their members' interests (Sikka et al., 1992; 1998).

Another major grey area in the expectations gap involves the public understanding and interpretation of certain peculiar terminologies in audit reports. These include "true and fair view" (UK) and "present fairly" (US). These terms have evolved along with the development of audit as a profession. According to Lee (1994:36):

> *"Lack of clear definition, both of the label and its supporting body of accounting knowledge is typically excused on the basis of different and changing circumstances. Specific operational meaning is given to the prescribed label by individual accountants acting as auditors. However, the situation has been complicated in recent times as a consequence of accountants defending their professionalism. Such defences have provided a partial meaning to undefined labels because they contain reporting criteria likely to create expectations of audited and reported information's potential to benefit its consumers".*

For good corporate governance that supports responsible and reliable financial reports that can satisfy all the stakeholders of a business, Rezaee (2003) recommended a "six-legged stool" model comprising the active participation of the board of directors, the audit committee, the top management team, internal auditors, external auditors and regulatory bodies. This, he suggested, will provide a holistic solution to the problem facing business establishments across the world.

The question of auditor independence has also been one of the most controversial concepts among audit professionals and academics. While some believe that

minimum contact and an arm's length distance based approach is necessary to ensure that auditors continue to be independent in mind and in appearance in order to be objective and impartial in making audit decisions, others believe that the concept of auditor independence is too vague and inconsistent with the practical realities of what auditing entails (Moizer, 1997). They believe auditors should naturally act objectively as they too have a long run economic gain to make for being independent. Auditor independence has to be reflected in the personal disposition of the auditors in terms of maintaining an unbiased, objective and independent attitude of mind, which allows them to evaluate a set of financial statements as disinterested, uninfluenced expert assessors. This necessarily has to be complemented by the auditors avoiding situations in which they will be perceived as not being objective (Moizer, 1997).

Similarly, Plumlee (1985) concluded from his study that auditors who participate in the design of an internal control system are more likely to ascribe less control risk to that system than auditors who do not participate in its design. This observation casts doubt on the judgement of auditors who perform both audit and non-audit services for the same entities.

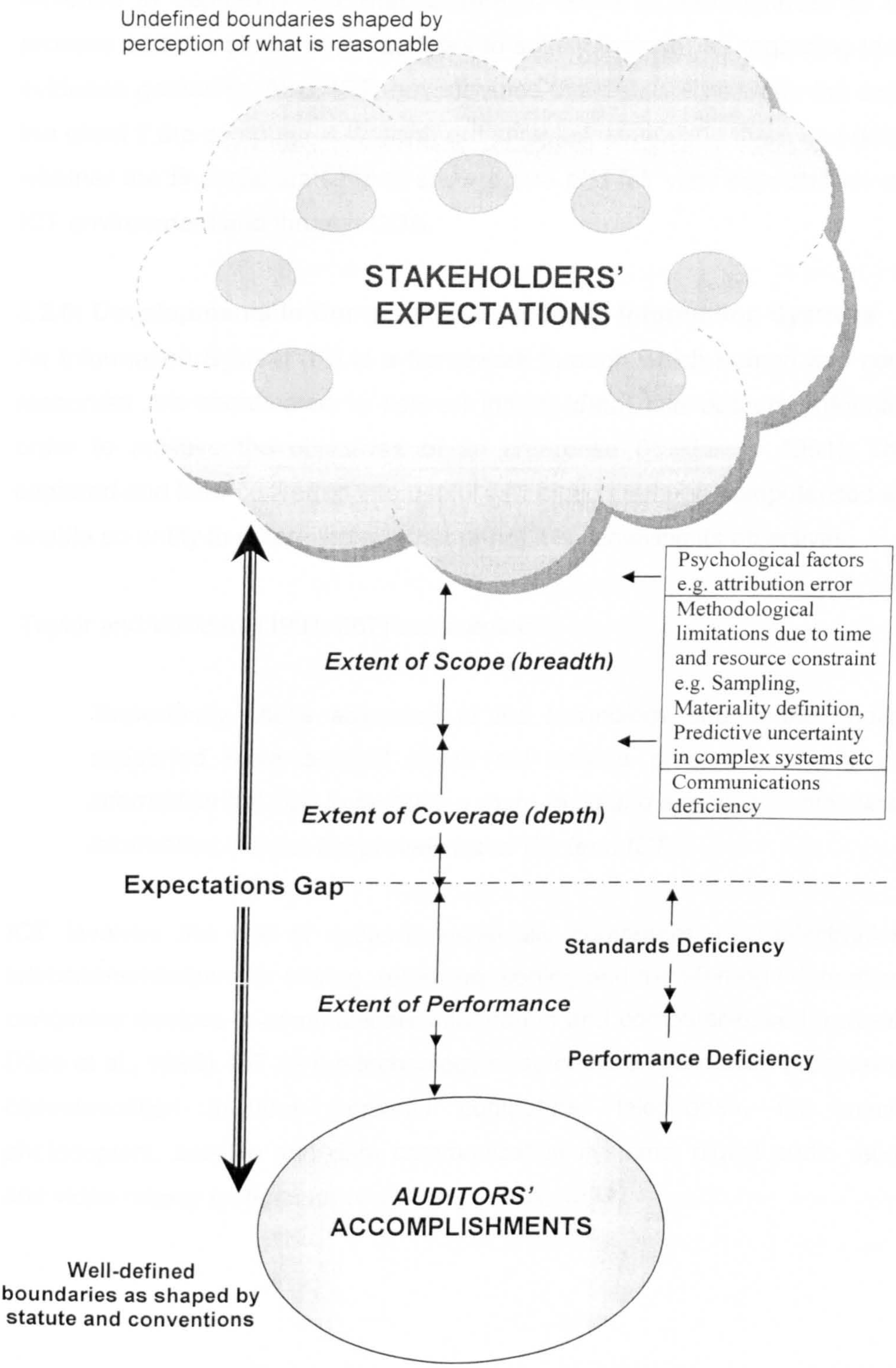
Suggestions on how to reduce the gap range widely and include considerations about who should appoint, remunerate or terminate (the appointment of) the auditor, length of audit engagement, rotation of auditors, banning audit firms from involvement in other non-audit services, enhanced audit fees, peer review, and the avoidance of non financial interests in client companies among others (Moizer, 1992; Perks, 1993). Efforts are currently going on in the UK, EC and IFAC to tackle the main potential threats to auditor independence, namely self-interest, self-review, advocacy, familiarity and intimidation.

Nonetheless, Sikka et al. (1998) advocated that whatever the efforts on the parts of regulatory authorities and auditors themselves, it will be difficult if not impossible to obliterate the expectations gap. Placing the arguments on the AEG within the contexts of socio-political and historical perspectives, the authors argue that as a social practice, it will be hard to streamline the meaning of audit in a way that will suit the numerous social divisions related to the practice. According to Sikka et al. (1998:332):

> *"... depending upon the strength of competing groups and the dynamics of their interaction, previously established meanings may be questioned, modified or abandoned".*

Based on Porter's (1993) identified components of the expectations gap, Omoteso et al. (2003) evaluated how ICT can be helpful in recognising and possibly overcoming the methodological limitations (such as sampling), communications deficiency (through COA and the Internet) and the performance deficiency (through the use of DSS and KBES) as shown in the diagram below. The study indicated that auditors' performance deficiency can, to a large extent, be reduced if not eliminated; the gap relating to audit coverage and scope can partially be reduced through the use of ICT; but the standard deficiency aspect cannot in any way be influenced by audit automation as this is entirely up to the standard setting authorities. However, ICT can play an important role by providing a communications infrastructure to enable wider consultation, faster dissemination, information repositories and faster, more flexible information search and retrieval facilities.

Figure 2.1: ICT and the Audit Expectations Gap [Omoteso et al. (2003:3)]



Furthermore, the obvious area in which ICT may help to close the gap is in the increase in objectivity ICT may ensure in terms of thoroughness of the audit process and the ability of the auditors to satisfy themselves regarding testing and evidence gathering. Also, ICT may increase the distance between the auditor and the client if the computer is working out samples, evaluating them and determining whether the financial statements show a true and fair view especially in a remote ICT environment and through COA.

2.2.0: Developments in Computerised Business Information Systems

An Information System (IS) is a framework through which human and computing resources are coordinated to convert inputs (data) into outputs (information) in order to achieve the objectives of an enterprise (Wilkinson, 1991). The data captured and later converted into useful information through computerised systems enable an entity to determine whether or not it is achieving its objectives.

Taylor and Williams (1991: 367) commented:

> *"Importantly, these advances in the technology and in the applications supported have brought about not only a greater ability to process information but also to facilitate a more rapid and effective communication of information, hence, the prevalence of the term ICT".*

ICT involves the use of systems especially computers, microelectronics and telecommunications for storing, retrieving, sorting and transferring information. ICT comprises devices to communicate information and computer-based technologies (Xiao et al., 1996). ICT as the technology of automated information processing and communication includes personal computers, telephones, fax machines, photocopiers, satellite and data communication systems, digital audio recording and video mixing systems among others (Monk, 1991).

The past decade has witnessed remarkable advances in logistical communication capabilities. Electronic Data Interchange (EDI), the Internet and the cross platform communications enabled by the World Wide Web, Hyper Text Markup Language (HTML) and its extension, the Extensible Markup Language (XML), as well as advances in telephony and satellite technologies all of which have facilitated communication within and between firms.

Investment in ICT also assumes importance as information increasingly becomes a crucial business resource. Again, the ever growing power of ICT at ever decreasing prices is leading to a wider adoption of computerised information systems by firms (Taylor and Williams, 1991). In the view of Carr (2003), ICT is considered a commodity similar to electricity as being central to running business and competing.

ICT is a highly dynamic phenomenon and management often face decisions on controlling ongoing investments in the technological enhancements while balancing the risk. This has also necessitated a change from traditional accounting control processes to increasingly complex information-systems-based control processes for advanced technology applications (O'Donnell et al., 2000).

Today, database-supported online systems allow business organisations to operate electronically. This has snowballed into improved efficiency in information processing in production and sales activities. Databases and online systems enable businesses to retrieve, classify and report activities more quickly (Date, 1995; Alles et al., 2002).

In the words of Alles et al. (2002:3):

> *"In most organisations today, transactions are taking place virtually 'continuously'.... As a result, all but the smallest firms have or soon will have*

systems to record such transactions in real time. With the ubiquity of bar coding, scanning, automatic transaction recording and low cost of data storage and retrieval, firms are no longer constrained to rely on conventional double-entry bookkeeping and a chart of accounts to aggregate and record information".

The desire to reduce the substantial cost burden incurred by business organisations in processing huge amounts of routine numerical data led to the introduction of computer systems through the use of simple algorithms. These cover accounting tasks such as invoicing, payroll and book-keeping (Wilson and Sangster, 1992). While most large organisations had their first experience of computerisation through accounting processes in the 1950s, medium sized organisations and the professional accounting firms could not afford to computerise their operations until the advent of minicomputers in the 1960s. Furthermore, the development of microcomputers in later years enabled smaller organisations (including small accounting firms) to computerise their accounting functions (Wilson and Sangster, 1992).

2.2.1: The Need for ICT Tools and Techniques' Use in Financial Statement Audit

Accounting is arguably the first area of business in which ICT tools and techniques have been applied. Although the application of ICT was first undertaken on the basic accounting systems, financial modelling packages soon proved highly beneficial in the analytical aspects of accounting (Carr, 1985; Clark and Cooper, 1985). Barras and Swann (1984) were of the view that the pace of ICT adoption by accounting as a profession was considered low due to the conservative nature of its practitioners. However, by the late 1990s, the profession had been compelled to adopt computerised facilities in its operations as a way of promoting efficiency, withstanding competition and reducing expenses (Manson et al., 1997; 2001). Banker et al. (2002:210) stressed this view thus:

"Advances in information technology have transformed many firms in the professional services industries, but perhaps none as much as those in the public accounting industry. Once a slow-paced and conservative industry, public accounting underwent tremendous changes at the turn of the millennium, sparked largely by the changes in the IT environment. Audit software and knowledge-sharing applications are two crucial components of these changes. Automation of audit tasks and use of specialised audit software has substituted IT for labour and changed the structure of audit teams".

The current global trend in ICT has had its impacts on virtually all spheres of human endeavour. The spread and dynamics of this trend have undoubtedly enhanced business operations in general and accounting practice in particular. As organisations adopt ICT throughout their processes, one of the presumptions underlying the modern audit process in this age is that the auditor must be comfortable in a wide range of technology environments, from a simple desktop system to fully integrated Enterprise Resource Planning (ERP) systems (Knechel, 2001). In the words of Tucker (2001:1):

"The explosive growth in information technology (IT) capabilities and the desire of businesses of all sizes to obtain competitive advantage have led to a dramatic increase in the use of IT systems to originate, process, store and communicate information..... In fact, there are few companies that don't rely on IT to at least some extent to achieve their financial reporting, operating and compliance objectives. As a result, it's rare to find an entity whose IT use does not also affect its independent audit".

This point of view is corroborated by Kanter (2001) who considered that ICT has drastically reduced the age long paper-based audit trails to almost non-existent. According to him, the modern auditor is required to be well-informed about the

clients' business environment as the audit will need to be structured in harmony with the client's transaction process environment for effectiveness.

In order to keep pace with the increasing trend of business technological sophistication, auditing is gradually shifting from the departmental audit paradigm to a process audit paradigm that cuts across multiple functional departments. This development will enable the auditor to understand and assess the key business processes of a client (performance measures), which in turn enhances the auditor's ability to determine whether each process objective has been incorporated into the client's operations taking risks and internal controls into consideration (Bell et al., 1998; Helms 2002).

The practice of auditing nowadays uses technologies and methodologies that are continually changing to measure up to business data processing methods. For instance, the introduction of computers in business brought about the creation of Electronic Data Processing (EDP) auditing. Databases and distributed computing have to a large extent changed audit risks and effect the utilisation of essential new audit tools. The advent of the Internet, the consequent internetworking of applications and the progressive computerisation of many corporate processes and procedures have accelerated the trend and demand for new, more timely assurance processes (Vasarhelyi, 2002).

ICT tools are now commonly used in a range of tasks, from simple assignments such as arithmetic calculations to complex ones such as flowcharting and statistical analysis. Others are audit toolkits (comprising standard PC software packages and purpose-written software), checklists, logit models, audit enquiry programs (capable of analysing and testing data in-depth), integrated audit monitor modules (programmed routines that continuously monitor real data and processing conditions), expert systems and internal control templates commonly utilised for identifying the strengths and weaknesses of a system. Examples include PwC's

Risk Control Workbench and Deloitte's Visual Assurance (Bell et al., 1998; Bierstaker et al., 2001).

Some audit firms have even moved a step forward by introducing neural networks/artificial aids in making audit judgements as part of an integrated audit automation system. ICT devices such as Electronic Data Interchange (EDI), Electronic File Transfer (EFT) and image processing are predicted to replace traditional audit trails in the near future thereby completely changing the entire audit process (Abdolmohammadi, 1987; Bell et al., 1998).

The continuous growth in computerised information systems in the business world is fast replacing traditional source documents such as purchase orders, invoices and cheques with electronic messages, and underlying accounting data such as electronic journals, ledgers and schedules. As a result of these developments, under real time accounting systems, much of the financial information and audit evidence are available only in electronic form (Rezaee et al., 2001). The process of making high-quality and timely audit decisions partly relies on the quality of the data and the existence of online real-time facilities as electronic and digital information is more flexible, accessible, transferable, storable, summarised and more organised than paper information.

Although auditors place a lot of emphasis on the quality of information available for their audits in terms of its adequacy, reliability and consistency, this can only be guaranteed through the evaluation of the controls surrounding a client's information processing system. The usual method of auditors performing such evaluation and testing at the year end will no longer suffice given the high volume integrated complex processing system that is now rampant in business organisations (Pathak et al., 2005)

As a corollary of the above, auditors are increasingly concerned about the implications of ICT for assessing risk and planning their engagements as ICT could have considerable impact on control risk. This may prevent the auditor from carrying out the desired substantive audit (Bell et al., 1998).

Bierstaker et al. (2001) predicted that, in the future, paperless audits will become commonplace as audit clients increasingly shift to paperless systems and audit software is developed that allows auditors to complete most procedures online. Consequently, there has also been an increased call for Continuous Online Auditing (COA) for both internal and external audit purposes as most businesses are adopting online real-time systems for their transactions. This call is meant to position auditing as an ever-relevant and dynamic business assurance service to the shareholders in particular and other stakeholders in general.

In order to audit online systems, auditors will have to integrate online audit software as their basic audit tool and gather evidence electronically. The use of such technology will create opportunities for modern auditors to use their time for higher level tasks such as understanding the client's business and assessing various risks rather than being entangled in the web created by numerous mundane tasks (Bierstaker et al., 2001).

It is possible that ICT might have benefited the accounting profession. This may be responsible for the increased adoption of ICT techniques by many firms. However, the increase in ICT-oriented accounting practice is not without its limitations such as lack of tailored and more focused information (King et al., 1991). Furthermore, management often faces the challenge of assessing the impact of ICT on the performance of their business. Audit managers and partners are increasingly required to justify ICT investment in relation to its overall impact on the firm's performance and productivity.

2.2.2: Efforts by the UK Accountancy Profession on ICT and Accounting

Literature on audit automation became more frequent in accounting journals starting from the late 1980s (Manson et al., 1998). Around the same period in the UK, various professional accountancy bodies engaged in some forms of research effort in terms of sponsorship and publications on ICT's impact on the accountancy profession. These bodies also organised (or sponsored) symposia, workshops and conferences on the subject.

The first major research effort in the UK on the impact of ICT on the accountancy profession was made in 1985 by the Chartered Institute of Certified Accountants (now called the Association of Chartered Certified Accountants - ACCA) in collaboration with the Department of Trade and Industry. The study made use of data collected through a questionnaire survey from 761 members in the UK, Hong Kong and Singapore (Chartered Institute of Certified Accountants, 1987). The study highlighted major changes ICT had brought into the accounting profession with regards to the accountant's roles and responsibilities, new opportunities and new challenges in terms of knowledge, skills and training. Subsequently, ACCA has been able to publish a number of ICT-related research works. These include: UK Business and the Information Superhighway: The Impact of the Internet on SMES (Lymer et al., 1999); The role of Accountants in the Provision of E-Commerce Support to small UK Firms (Chaston and Mangles, 2001); The Impact of Electronic Business on Accountants: A Shareholder Value Perspective (Philips and Kirby, 2002) and Information and Communications Technology in UK Accounting Education (Marriott et al., 2003).

Similarly, the Institute of Chartered Accountants in England and Wales (ICAEW) in 1989 published the report of a study titled, "IT and the Future of the Audit". This was followed by the institute's research effort relating to an investigation among accountants in practice on the use and penetration of computers and software in the profession. This research adopted a qualitative approach using the Computer

Assisted Telephone Interviewing system to collect data from 750 respondents. The results were published by the institute's IT faculty under the title, "IT Usage in Accountancy Practices Survey" in 2003. The key areas covered by this publication are the practice IT environment, digital communications and the IT budget. Also, the ICAEW published research carried out by Jones and Xiao (2002) on "Peering into the Future: Financial Reporting on the Internet by 2010". This was followed in 2003 by "New Reporting Models for Business" which expounded the benefits of Internet reporting. The latest of these efforts is the institute's publication titled, Digital Reporting: A Progress Report (ICAEW, 2004).

For its part, the Institute of Chartered Accountants of Scotland (ICAS) sponsored a team of researchers from the Department of Accounting, Finance and Management of the University of Essex (UK) to investigate the use of ICT in planning, controlling and recording of audit work. This work was published by the Institute in 1997 (Manson et al., 1997). It also published "The Development of Corporate Web-sites and implications for Ethical, Social and Environmental Reporting through these Media (ICAS, 2004).

The IT Panel of the Chartered Institute of Public Finance and Accountancy (CIPFA) conducted an online survey to assess how its members work in an IT environment. The survey was primarily aimed at those whose roles were directly involved with aspects of IT such as designing systems, buying or auditing (Chartered Institute of Public Finance and Accountancy, 2005). Furthermore, it is in realisation of the growing need and significance of ICT that the Institute of Internal Auditors in the UK and Ireland dedicates a specialised qualification to the ICT area of internal audit. This is called the Qualification in Computer Auditing (QiCA).

2.2.3: Developments in Audit Packages

The realisation of the advancement in computerised information systems (CIS) has often led to the development of various audit software packages to cope with the

challenges. One of the earliest software applications in this regard is the Electronic Data Gathering Analysis and Retrieval (EDGAR) system developed in the late 1980s. EDGAR is an electronic data processing system that is capable of receiving an organisation's financial statements electronically, allowing for their review by auditors in a like manner and permitting computerised dissemination of information to interested stakeholders in the business. This is carried out using an online real-time system. Today, commercial software such as Audit Command Language (ACL) for Windows, Interactive Data Extraction and Analysis (IDEA) and electronic working papers are widely used by audit firms to enhance their efficiency.

ACL and IDEA are said to be capable of improving audit efficiency as a result of their ability to carry out a wide range of audit tasks that were previously completed manually. These tasks include footing ledgers, counting records, stratifying accounts by size, extracting data, downloading information for analytical review, selecting samples for detailed audit testing, generating confirmations and identifying and reporting exceptions and unusual transactions (Bierstaker et al., 2001).

Bailey et al. (1985) developed a Decision Support system (DSS) called TICOM to assist auditors in designing, evaluating and analysing internal control systems. Hansen and Messier (1986) developed a Knowledge-Based Expert System (KBES) called EDP-Xpert, to evaluate controls in an advanced electronic data processing system. Dungan and Chandler (1985) developed a KBES called AUDITOR to estimate a bad debt expense. The then Peat, Marwick, Mitchell & Co used a micro-computer based expert system software shell, M1 to develop a KBES for assessing the collectability of bank loans (Elliott and Kielich, 1985). Other early packages developed were ICES (1986) for assessing internal control, CFILE (1986) for examining bad debts, AUDITPLANNER (1986) for determining materiality levels and CHECKGAAP (1986) for materiality assessment (Connell, 1987).

Virtually all the big four international accounting firms continue to invest in expert systems development in order to improve both the efficiency and the effectiveness of the audit process (Swinney, 1999). Again, Lanza (1998) outlined the benefits of using auditing software as reducing costs, better understanding of clients' businesses, reduced errors, versatility in analysis and increased audit quality among others. However, as the ICT boost in the later part of the last century coincided with increased levels of unemployment in the developed economies, research interest on the link between these two phenomena has become more intense over the last few years.

2.2.4: Computer Auditing and Audit Automation

The term audit automation is often confused with a much older term, computer audit, as the two involve the use of computerised systems. However, the distinctions between the two are explained in the following paragraphs.

2.2.4.1: Computer Auditing

The two main approaches available to an auditor of a CIS are *auditing round the computer* and *auditing through the computer.* The former treats the computer as an ordinary box. It assumes the processing steps must be functioning well as long as actual outputs are the correct results expected from a set of inputs, whereas the latter opens the box and assesses the processing operations within it. It assumes that once the processing system contains sufficient controls, the output can be considered reliable. For the first approach to be suitable, the following conditions must necessarily hold: the audit trail must be complete and visible, the processing operation should be simple and straightforward and the necessary documentation such as system flowcharts and record layouts must be available (Chambers and Court, 1991).

Although audit firms have historically relied on special experts to assess the reliability of computerised systems, a number of auditors still feel that they lack the

expertise to adequately evaluate and test automated systems (Bell et al, 1998). However, current trends in ICT suggest that auditing could not be carried out effectively without fully understanding the logic of the computerised information processing. As such, more auditors are learning about and becoming increasingly knowledgeable in data processing techniques so as to be able to audit through the computer especially in this 'digital age'.

The increase in the level of the automation of business processes has made it almost compelling for the accounting systems and procedures in such businesses to be computerised. As a result, the traditional approach of treating a computerised system as a black box and planning to audit around the computer has become insufficient and irrelevant. The reasons for this assertion can be seen to arise from prevalent factors such as the lack of hard copy, the sophistication of record posting, the vast increase in legislation relating to data protection and data theft which requires auditors to consider the security of systems and the exposure of their clients to hidden liabilities for unauthorised disclosure among others.

Appropriate to the 'digital age', many auditors are seeking to acquire more sophisticated knowledge and skills in computerised data acquisition and processing techniques, with the goal of auditing through the computer. Auditing a computer-based system involves assessing internal controls within the computerised information system (CIS) environment to verify and ensure the validity, reliability and security of information. It also involves assessing the efficiency and effectiveness of the CIS environment in economic terms (Gallegos et al., 1987).

The main differences between the audit of a manual and a computerised accounting system are reflected in the audit approaches and the nature of tests performed. In a computerised system, the audit approach should ideally include the auditor's participation in system design, more frequent audit visits and complex

system review while the audit tests emphasise control batches of items, processing systems and control programs.

The examination of the CIS by auditors is covered by 'computer auditing' and it involves ensuring the integrity of data held within a CIS and protecting the privacy of individuals or entities to whom the data pertain. The integrity of information is assured through monitoring of controls throughout the process of design, implementation and operation of CIS and concerns all the physical, procedural and technical aspects of security (Gallegos et al., 1987).

The term computer auditing, sometimes better described as 'auditing in a computer environment', comprises auditors' use of file interrogations in data analysis, the use of test data to confirm programs' accuracy and the use of programs to confirm the accuracy of other programs among others (Court and Muggridge, 1991). In other words, computer auditing concerns the use of electronic information technology devices and techniques for auditing a client's computerised systems.

Apart from the traditional role of providing an assurance service to all the stakeholders in a business through the establishment of the integrity of an organisation's financial statements, today's auditor is also expected to add value by evaluating the efficiency, effectiveness and economy of an organisation's business processes. This task is particularly complex in a CIS environment.

The latest of the IT audit tools is Control Objectives for Information and Related Technology (CobiT). Released by the IT Governance Institute of the Information Systems Audit and Control Association, CobiT extends COSO (Committee of Sponsoring Organisations of the Treadway Commission)'s fiduciary role as an internal control framework to cover the aspects of quality and security as key control objectives in order to take care of IT controls. This is an important area of the overall internal controls assessment for financial reporting (Chan, 2004). In

sum, the four main domains proposed by CobiT are Planning and Organisation; Acquisition and Implementation; Delivery and Support; and Monitoring. These four domains serve as the pivot upon which CobiT's thirty-four control objectives rotate.

2.2.4.2: Audit Automation

According to Court and Muggridge (1991: 430):

> *"More recently, the scope of auditing in a computer environment has widened. It now includes 'audit automation' such as the maintenance of audit records on computer files, the application of programmed quality control procedures and the use of automated questionnaires or expert systems covering aspects of an auditor's knowledge base. Such procedures involve the use of the auditor's own computer systems to assist in the administration and recording of the audit procedures".*

The search for ways of improving audit efficiency has resulted in a lot of effort from audit professionals and academics to research into the roles ICT can play in reducing the expense of time, human effort and other resources. Today, phraseologies such as audit automation, audit technology, continuous auditing, online auditing, real-time auditing, computer-aided auditing, automated auditing, audit decision support systems, audit expert systems, computer-assisted auditing techniques and the like have been coined by different writers, particularly in Europe and America to describe the use of ICT in the planning, implementation and management of various audit tasks.

In sum, audit automation can be looked at from two main perspectives. First is the use of ICT tools and techniques in the audit procedures (from engagement to final reports) as well as utilising computerised decision aids while the second concerns the use of these tools and techniques in the firm/entity's internal operations (administration and accounting) as an ordinary business establishment. The two

combined are ordinarily expected to lead to overall enhanced performance in terms of quality of service and profitability.

Automating the audit involves the use of ICT in performing audit tasks that were hitherto being carried out manually for the purpose of improving efficiency and effectiveness. These encompass reducing costs, audit risks and response time and improving quality (Fischer, 1996; Brown, 1991; Wilson and Sangster, 1992; Manson et al., 1997). Aside from these, Manson et al. (2001) suggested that it is the external competition, particularly fee pressure, that drives the creation of systematic control within the audit firm thereby leading to the urge to make the quality of the audit attractive to the clients through the use of ICT so as to convince them of the auditor's competence and capability in the competitive audit market.

In addition, Porter and Miller (1985) argued that the integration of ICT applications can enhance the competitive position of a firm through its impact upon the value-added chain. Similarly, Antonelli (1988) put forward the view that the use of ICT has become a major source of competitive advantage and that the benefits of such systems surpass the costs. Antonelli (1988: 20) identified the following as the main benefits of using computer networking: reduced working capital through optimum stock operations, better specialisation of business units, purchasing economies of scale, integrated manufacturing and marketing, financial economies of scale and economies of scale in data processing.

It might be worthy of note that the increased use of ICT tools and techniques by accounting firms was taking place at the same time as the number of both their clerical and professional staff was being reduced (Bagnall, 1991). This, therefore, raises a vital question: does audit automation affect the workforce in the industry? And if this was true in the early 1990s, is the situation still the same in the mid 2000s? This study is expected to provide an answer to this question.

2.2.5: A Review of Studies in Audit Automation

Fischer's (1996) study was one of the pioneering comprehensive works on audit automation. The study examined the implementation, adoption and use of technologies by audit practitioners in some of the then "big6" audit firms. Its results indicated that the use of technology (proprietary) completely fashions new audit approaches rather than simply automating the existing manual steps and, as a result, most of the benefits culminating in enhanced audit efficiency which earlier writers directly ascribed to the use of new technologies were in a real sense the result of a reduction or elimination of certain procedures inherent in the manual approach.

Fischer's (1996) study was able to achieve its objective of developing an understanding of how new proprietary audit technologies (designed, validated and implemented by large audit firms) could produce audit efficiency thereby making an original contribution to the existing literature in the area of audit automation while using a unique methodology, the interpretive grounded field study involving observations and interviews.

Using five US offices of one of the large accounting firms with huge ICT investment in software and knowledge-sharing applications, Banker et al. (2002) conducted an empirical investigation to evaluate the impact of ICT on a public accounting firm's productivity. The study adopted a triangulation of both qualitative (interview) and quantitative (questionnaire) research approaches in a firm that had just computerised its audit procedures, the study's results indicated that while other factors (incentive scheme, organisational structure, management team, business strategy, stable market environment etc) remained the same in both the pre and post automation periods, ICT happened to be the only factor that had positively affected the firm's productivity. The interviews conducted also signified that there were potential impacts of ICT on audit efficiency at individual, business process and work group levels.

The uniqueness of the research lies in the fact that it is the first and only study so far that examines ICT's impact on an accounting firm's pre and post automation productivity. In addition, its combination of both qualitative and quantitative research methodologies makes it stand out in the literature on audit automation.

An empirical study was conducted by Manson et al. (1997) using the triangulation of structured questionnaire and semi-structured interview in the largest forty UK accounting firms on audit automation. The results indicated that it was the large and medium sized audit firms that employed ICT extensively in the planning, controlling and recording of their audit work while only a few of the other smaller firms used it (especially the general-purpose packages) due to the size of their client base and ICT's capital intensiveness. Also, the research indicated that although there was not much difference in the extent of ICT usage between the three groups of audit firms in certain tasks, smaller firms did not utilise tailored audit programmes. The primary motivations for the race for automation of audit according to the study were to improve quality, reduce costs and to keep pace with the wave of competition within the industry. However, it was suggested that these motivations were necessarily balanced with the associated costs, which included the costs of training, learning, implementation and documentation (Manson et al., 1997).

The study was able to achieve the objectives for which it was carried out. These included identifying the various ways in which audit automation is used and the extent of such use, the issues in the development and implementation of audit automation, the costs and benefits of audit automation and the effect of audit automation on human resources issues arising from the use of ICT in the audit process. In addition, the study was able to contribute to knowledge by assessing the potential impact of ICT on the audit profession as a whole rather than on individual accounting firms as previous works had emphasised.

In a related comparative study, Manson et al. (1998) conducted a research investigation through a postal survey using the partners responsible for ICT in the largest forty audit firms in the UK and the largest fifty audit firms in the US as the research subjects. The questionnaire was comprehensively designed to cover the availability of personal computers to auditors; the pattern of computer use by auditors in a wide range of planning, controlling and recording of audit tasks; the benefits and costs of implementing audit automation; and human resource issues.

The findings indicated that US audit firms were more advanced in the use of ICT than their UK counterparts. This is also evident in the fact that over 70% of the studies reviewed on audit automation emerged from the US. Furthermore, the study suggested that the large firms in both countries were implementing automation much more fully than other categories of firms. Also, the study showed that the automation practices in both countries were mediated by certain cultural parameters in the context of operating (socio-economical and technological) environments rather than being standardised as suggested by earlier literature on globalisation of audit practice (Manson et al., 1998). The study was able to tackle the main purposes for which the research was carried out, that is, to document the extent of the implementation of audit automation in UK and US audit firms and to assess the impact of the globalisation of auditing on the extent of audit automation.

Also, the study was able to draw meaningful conclusions on the similarities and differences in the use of audit automation in both countries thereby blazing the trail in comparative audit automation research involving two leading countries in the fields of information technology as well as auditing. However, the results of the study would have been further strengthened if factors such as political and legal frameworks (including ICT and auditing standards and regulations) had been explored. In addition, the time lag (of up to four years) between the collection of data and the actual date of publication might have some effects on the currency of the conclusions due to the recent developments in ICT.

Manson et al. (2001) explored the role audit automation plays as a form of control within audit firms. Using two of the then "big5" audit firms as a case study, the authors suggested that ICT could have an impact on organisations in two ways. First, the introduction of ICT could have specific implications for the behaviour and attitudes of individuals working in organisations. Second, ICT could affect the structure and processes of the organisation. Therefore, the study explored both the individual and structural relationships involved in the use of ICT in audit firms.

The study was underpinned by Giddens' structuration theory (revolving around signification, legitimation and domination) and the research on information technology by Coombs et al. (1992) which developed three specific concepts of culture, control and competition. The authors stated that agents in organisations draw on the rules and resources embodied within ICT in conducting their tasks (agency theory). However, "*in their very use of IT they unconsciously reaffirm its importance, form and content, and reproduce those rules and resources as their organisation's structural properties. It is also possible for agents to change the technology and hence more directly affect the structure of the organisation*" (Manson et al, 2001:3). The paper was also able to draw the conclusion that ICT is central to audit firms' competitive position and recruitment strategy to attract the best available manpower while auditors, too, recognise ICT skills as necessary for career development.

Manson et al.'s (2001) study usefully combined sound theoretical insights with an appropriate methodological approach. There was a clear conceptualisation of the problem. This was balanced with the modest aim which they set for their study, exploring the impact of audit automation on work practices in audit firms. The study also showed a good blend of the data collected with the theoretical arguments identified in the literature.

Bierstaker et al. (2001) assessed the impact of ICT on the audit process. The study adopted a qualitative approach using the interview technique in three large international accounting firms (three of the then "big5" accounting firms) and the observation technique in one more of the then "big5" accounting firms. The study concluded that ICT had produced tremendous gains in audit efficiency and effectiveness and that technology will continue to have a dramatic impact on every phase of the audit process. The study did not reveal the details of its data gathering and analysis. It also failed to utilise any theoretical framework. These two fundamental deficiencies put its academic strength in question.

An empirical investigation into the relationship between the computerisation of accounting systems and the incidence and size of audit differences by Bell et al. (1998) suggested that the majority of audit differences arise as a result of incorrect computations, differences in management and auditor judgement, faulty initial identification and processing of transactions and overworked accounting personnel among others. The study put forward the idea that audits utilising computerised information systems are more likely to produce audit differences (misstatements) as a result of factors such as incorrect manual computations, inadequate and incorrect application of internal controls (Bell et al., 1998).

The study was able to empirically investigate the research question using an appropriate methodological paradigm, positivism. It was also able to move the frontiers of knowledge forward by examining the impact accounting system computerisation might have on audit differences. However, the study did not make a clear-cut distinction between the effects the computerisation of accounting systems and that of audit processes might have had on the incidence and size of audit difference. The two aspects were rather muddled together. Moreover, the time lag between the audit engagements used in the study and the time the study was published (1989 to 1998) is almost a decade. This time is long enough to

affect the currency and validity of its results thereby only giving a historical perspective.

Messier et al. (2004) conducted research on the causes and detection of misstatements by auditors and the relationship of these misstatements with ICT. Drawing on data from 58 audit engagements presented by Norway's "big6" accounting firms, the study indicated that missing and poorly designed controls and excessive workload for accounting personnel are more likely to be the causes of misstatements in computerised business processes than non-computerised ones.

Compared with the work of Bell et al. (1998), the study indicated that control problems had increased in general and they were more prevalent in computerised business processes, that is, a slackening in the control environment. The study was able to provide a better understanding on causes of misstatement in a computerised setting as previous studies only identified incorrect manual computations and incorrect application of internal controls as the main reasons for such misstatements (Bell et al., 1998). Although COSO and CobiT frameworks were referred to by the authors, the study failed to show their real application in practice. In spite of this minor deficiency, the study was able to add something new to the existing body of knowledge by providing a better insight into the causes of misstatements in a CIS environment. Besides, it made use of real life historical data which adds credibility to the reliability of its results.

Bons et al. (1999) presented a new theory on the auditing of inter-organisational trade procedures. This they did by offering an initial formal theory on the design of trustworthy trade procedures. These general principles were then modelled using the 'audit daemon approach' (using an automated aid in diagnosing control weaknesses in a newly designed trade procedure) earlier developed by Lee (1991) to produce an artificial intelligence approach. This was further presented for the automated analysis of the trustworthiness of inter-organisational trade procedures.

The study was highly theoretical and hypothetical. Therefore, the efficacy of its presumptions and propositions still stands open to empirical proof.

Ratcliffe and Munter (2002) examined the historical development of the use of ICT in internal control and financial statement audit. The study provided a historical mapping of the development of ICT use in internal control and financial statements by looking at the processes and the regulatory mechanisms that inspired their development. The study explained the distinction between AICPA's SAS 55 (Consideration of Internal Control in a Financial Statements Audit) and SAS 94 (The Effects of IT on Internal Control and Auditors' Understanding of Internal Control). SAS 94 in addition to the requirements of SAS 55 stipulates that auditors should consider how an organisation's ICT use affects their audit strategy. The study also considered the different ways in which electronic evidence is different from paper evidence. These were dealt with under the headings of difficulty of alteration, prima facie credibility, completeness of documents, evidence of approvals, and ease of use as well as clarity. The authors also examined how these aspects impacted upon internal control.

Caglio (2003) used Giddens' structuration theory to underpin a study on the impact integrated information systems - that is, Enterprise Resource Planning (ERP) – have had on the modern accountant. The study advocated a form of 'hybridisation' between the roles of the accountant on the one hand and those of IS and line operators on the other. It also conceptualised the potential change in accountants' practices and position as a structuration process.

Using a case study approach to collect qualitative data through unstructured interviews, the study was able to meet its stated objectives of producing a theoretical understanding of the changing role of the accountant as a result of ERP and providing empirical evidence of the processes involved in such changes. The data used in the study were recent and this adds further credence to the reliability

of its findings. Perhaps observations and informal social contacts as methods of gathering data might have provided a better insight into the phenomenon being studied. However, the study was able to break new ground in accounting literature by using a dynamic framework to map the impact of ERP on the accounting profession.

Xiao et al.'s (1996) study examined the role ICT plays in Corporate Financial Reporting (CFR). The research derived from previous studies on the subject and used a contingency perspective to provide a sophisticated and analytical framework that the evaluation and prediction of ICT impact on corporate financial reporting requires. The authors noted that previous studies had examined the development of ICT use in accounting, the impact of ICT use on accountants, accounting function and accounting firms, as well as the benefits of ICT use in CFR. What seemed to be lacking was research into the impact of ICT on external reporting, and more attention to the needs of users of financial information. This research vacuum, Xiao et al. (1996) claimed, would be filled by the adoption of a contingency approach.

They argued that ICT and organisational change requires investigation, in the same way the impact of ICT on organisations is investigated. Hence, a more appropriate framework would consider a number of contingent factors, which might affect the impact of ICT on CFR. These contingent factors were put in the form of six research hypotheses, which were then analysed and discussed. The study was able to assess ICT's impact on CFR with a flexible theoretical framework, the Contingency Theory of Organisation (CTO), which shows that ICT's impact varies on different aspects of CFR and patterns of change were contingent upon environmental, organisational and managerial characteristics.

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The contingency perspective presents a broader and more simplistic approach to investigate the impact of ICT on CFR. Unlike the universalist perspectives, the theory takes a middle course between the ICT imperative and the organisational imperative. Similarly, the contingency perspective differs with the particularist views that the effects of ICT are unpredictable as a result of social and political factors. It rather holds that the effects of ICT are to a reasonable extent predictable.

Xiao et al.'s (1996) study was able to contribute to the existing perspectives on the impact of ICT use. The contingency approach provided an alternative standpoint to the universalist and particularist perspectives. This would enable a wider and more broad-based investigation into ICT's impact in future studies. However, as the work was only able to draw hypotheses that were based on the CTO, it currently lacks an empirical basis to the investigation. Therefore, the potency or otherwise of the perspective is yet to be proven and it is one of the aims of this study to test the theory.

Another related study carried out by Wilson and Sangster (1992) investigated the main motivations for and constraints upon audit automation on the one hand and the effects of organisations' size and working environments on audit automation on the other. The study suggested that constraints and motivating factors were not the reasons for the imbalance observed in different organisational sizes examined but a result of the nature of tasks performed in different environments (industrial and commercial group and professional accounting firms). The study concluded that domain characteristics, historical factors and skill availability were the main variables influencing automation. The difference in the automation level according to the authors was because accounting tasks in industry are more algorithmic while those in accounting firms require more judgement and processing of qualitative information.

Wilson and Sangster's (1992) study was able to anticipate the ideas put forward by Xiao et al (1996) by assessing ICT's impact using different contingent factors. The study combined an appropriate methodology (quantitative) with a thorough analysis to draw out its conclusion which stated that ICT could have a positive impact on audit efficiency and effectiveness depending on the presence or otherwise of certain other factors such as domain characteristics, historical factors and skill availability. The only drawback of the study was that it lacked a sound theoretical underpinning.

Flesher and de Magalhaes (1995) carried out a study involving some randomly selected members of the Institute of Internal Auditors (US) to examine the scope of automation in internal audit departments, the internal auditor's use of working paper software programs and the rationale behind non-automation of the internal audit function. The study suggested that while most internal auditors used computer technology extensively, their departments were still paper-based.

The study also showed that ICT as evident in the use of electronic workpapers made it possible for internal auditors to exceed their annual audit plans at less cost, to promote efficiency and to enhance the quality of evidential matter in terms of neatness and conformity with standards. However, several reasons such as the initial investment cost and lack of technical expertise were given as reasons for non-automation.

The study, in addition, put forward the idea that the automation of audit workpapers was likely to lead to systemic changes in the way internal audit departments were operating as new audit technologies both automate previously existing audit procedures and introduce new audit approaches. Also, respondents were unanimous in their belief that the shift from paper-based workpapers to paperless audits was no longer a matter of if but when.

Flesher and de Magalhaes's (1995) study was able to break new ground in the study of ICT's impact on auditing by examining internal audit departments. To a large extent, it was the first to be carried out on internal auditors. Notwithstanding its contribution to the body of literature, the non inclusion of auditors and audit departments of large organisations in the study might have affected its outcomes as they are the ones that are likely to use more computerised tools and techniques because of the huge cost these systems require. Added to this, the study failed to examine the implications of ICT on staffing issues of internal audit departments.

Chou et al. (1998) proposed a TQM-based information system auditing framework to guide the process of software quality assurance and as a way of enhancing the effectiveness and efficiency of the software quality management. They study suggested that because software users and customers require assurance on the quality of the packages they buy, the philosophy of Total Quality Management (TQM) which is customer-oriented would serve as a useful framework for software auditing and quality assurance.

Their proposed framework takes care of the weaknesses inherent in the traditional approach. These include enabling the auditor to be proactive rather than being reactive and the promotion of enhanced communication capabilities. Besides, the framework is suitable for software quality assurance because TQM is becoming the mainstream of quality control in most establishments.

2.2.6: Computer-Assisted Auditing Tools and Techniques

Computer-assisted auditing tools and techniques (CAATTs) have been in use for over two decades but the dynamic nature of the business technological environment has caused a continuous introduction of new software programs to cope with the challenges of auditing in such a volatile terrain (Coderre, 1996). CAATTs revolve around the use of special software packages in viewing the overall business operations and examining a large volume of files within a very

short time. CAATTs permit the auditor to be able to carry out data interrogations by using historical data to identify anomalies for further investigation of the specific area(s) concerned. This is particularly helpful in a fraud investigation exercise as the program is capable of re-performing 100% of certain transactions and a wide range of analysis of ratios and figures (Coderre, 1996).

Coderre (1995) examined the effect of CAATTs as an integrated approach to automation as against the uses of CAATTs in piecemeal applications through a study on the audit of the management of commissions and bonuses. The study employed the use of CAATTs in the planning, implementation and reporting phases of the audit. The results showed that:

> *"In isolation, each use of the CAATTs effectively reduced the manual tasks associated with specific aspects of the audit. Collectively, however, the combined automated tools and techniques served to maximize the efficiency and effectiveness of the entire audit process"*, (Coderre, 1995: 3).

Coderre (1996) assessed the efficacy of CAATTs in fraud detection. He summarised the various actions available through CAATTs and concluded that they could help the auditor to identify symptoms early in the life of a fraud with the aid of digital analysis which involves the examination of patterns in data. However, this was not backed up by any real life cases.

Coderre (1995; 1996) was able to further entrench the relevance and significance of CAATTs to the modern auditor. However, the author's approach to the issues surrounding the operation of the mechanism may make it appear to be a simple process that would enhance auditors' effectiveness and nip every fraud attempt in the bud, whereas the connivance of two or more individuals to perpetrate a fraud could still beat the CAATTs.

Coderre (2000) discussed the vulnerability to control breaches of the increased complexity of internal control systems occasioned by technological advances in distributed processing, worldwide networking and remote access to corporate systems. He advocated the use of CAATTs by means of digital analysis techniques for fraud investigation with the help of pre-defined criteria based on investigators' accumulated years of experience. He also recommended a pro-active approach on the part of internal auditors in order to obtain meaningful results as CAATTs do not necessarily solve all the problems associated with fraud investigation.

Boritz and Hunton's (2001) study was able to evaluate the extent to which systems reliability assurance provided by an auditor affects potential service recipients including firm owners, managers, creditors and investors. The study adopted an experimental approach with a sample of 481 middle and upper level managers to achieve its objective using assurance factors such as availability, security, integrity and maintainability as basic parameters. The results suggested significant effects with respect to all four assurance indices which implied that stakeholders might give too much weight to auditor-provided systems reliability assurance and this could subsequently lead to overreliance on the anticipated integrity of the system. An apparent drawback of the study is that it failed to consider the effect the cost of auditors' assurance might have on the responses as this might mean a higher fee for the service recipients in the final analysis.

2.2.7: The Use of Decision Aids in Auditing

In the words of Dalal (1999:1)

> *"With the world's population likely to increase to unimaginable levels and due to the complexity in the nature of transactions, applying audit procedures will be increasingly dependent on software. Artificial Intelligence and Expert Systems are therefore useful and perhaps, inevitable in the conduct of the present day audit".*

Efforts have been made in developing decision aids comprising simple decision support systems and highly complex artificial intelligence-based systems (knowledge-based expert systems and neural networks) to assist auditors in making judgements (Abdolmohammadi and Usoff, 2001). The objective of these decision aids is to assist auditors to make better decisions by taking care of potential biases and omissions that could have ordinarily affected such decisions. While it is widely believed that these systems should be used as mere aids or inputs into the auditor's final determination of audit results due to the degree of versatility and sensitivity such judgements require (Elliott and Jacobson, 1987; Manson et al., 1997; Abdolmohammadi and Usoff, 2001), some other empirical results indicated that auditors do over-rely on expert systems output (Glover et al., 1996; Swinney, 1999).

A model of the decision process is important in order to identify the areas of auditing where Decision Support Systems (DSS) and Knowledge-Based Expert Systems (KBES) could be applicable (Abdolmohammadi 1987). According to Carlson (1983) as cited in Abdolmohammadi (1987), a typical decision process should necessarily encompass three basic iterative phases. These are Intelligence (which involves gathering data, identifying objectives, diagnosing problems, validating data and structuring problems); Design (which comprises manipulating data, quantifying objectives, generating alternatives and assigning risks or values to alternatives) and Choice (which involves generating statistics on alternatives, simulating results of alternatives, explaining alternatives, choosing among alternatives and explaining choice).

Various benefits have been advocated as accruable from the use of decision aids for audits. These include efficiency and effectiveness (Abdolmohammadi and Usoff, 2001); consistency (Brown and Murphy, 1990); structure for audit tasks (Pieptea and Anderson, 1987); improved decision making and communication (Brown and Murphy, 1990); enhanced staff training (Elliott and Kielich, 1985);

expertise development for novices (Eining and Dorr, 1991) and shorter decision time (Eining and Dorr, 1991).

However, the following have been identified as possible drawbacks of adopting decision aids: prolonged decision processes as a result of exploring more alternatives (Mackay et al., 1992); the huge cost of building, updating and maintaining systems (Pieptea and Anderson, 1987); the inhibition of novices' knowledge base (Murphy, 1990); the inhibition of professional judgement development (Yuthas and Dillard, 1996) and the risk of the tools being transferred to competitors and the possibility of their being used against the auditor in a court of law for having overrelied on the evidence of decision aids (Abdolmohammadi and Usoff, 2001).

With respect to litigation, the use of decision aids in arriving at a judgement is a double-edged sword. An auditor may be liable for not adequately using a modern decision aid in arriving at a judgement that turns out to be erroneous just as he may be liable for basing his judgement solely on an expert system to make an incorrect judgement (Ashton, 1990; Sutton et al., 1994).

Abdolmohammadi (1987) summarised the similarities and differences between DSS and KBES thus:

Factor	Decision Support Systems	Knowledge-Based Expert Systems
SIMILARITIES:		
Staff training	Provide online training	Provide online training
Knowledge sharing	The model in DSS is shared by all decision makers	The expertise of an expert is shared with all decision makers
Efficiency	Process data and model faster	Focus only on factors (decision rules) relevant to the decision
Final decision support	Provides 'optimal solution'	Provides 'second opinion'
DIFFERENCES:		
Task domain	Semi-structured	Unstructured
Model	Normative optimal model	An expert's decision rules
Search	Numeric/algorithmic	Symbolic/heuristic
Output	Optimal solution	Satisfactory answer
Flexibility	Modification difficult	Modification generally easy
Cost	Inexpensive	Very expensive

Table 2.2: Abdolmohammadi (1987:179)

However, the current trend suggests that neural networks, DSS models and KBES capabilities will merge as veritable ICT tools for auditors as this will combine the advantages to the greater benefit of all parties.

Abdolmohammadi's (1987) study was one of the pioneering works that encapsulated the use of DSS and KBES in auditing with a view to providing research guidance and directions for future studies in the area as this might enhance audit efficiency and effectiveness. The study was able to evaluate earlier decision aids developed in terms of their usefulness and continuous relevance in audit practice. It also discussed some directions for future research on DSS and KBES. These include:

- classification of audit tasks by complexity
- search for a 'normative model' or an 'expert'

- methods of eliciting knowledge
- flexibility
- developmental time and cost

Abdolmohammadi (1991) conducted a survey of forty-nine audit managers and partners to identify the primary decision aids out of a list of four (automation, DSS, KBES and human processing) applicable to a range of audit tasks. The study was based on the task complexity model proposed by Abdolmohammadi and Wright (1987) which indicated that audit tasks can be classified according to their level of structure and the suggestion that the structure of such tasks could have an impact on the applicability of decision aids to the tasks. The result suggested that the complexity of the audit tasks and auditors' rank and specialty have a considerable effect on the decision aid choices of the respondents. The more structured the audit task, the larger the support for automation; more partners showed support for automation than managers; and more non-EDP managers showed support for automation than EDP managers.

The study contributed to the existing body of knowledge by investigating the impact of task structure and auditors' rank on the decision aid choices of auditors. A possible drawback of the study, however, was the low number of research subjects from semi-structured firms compared to the other two groups, structured and unstructured firms (seven out of forty-nine), perhaps limiting the generalisability of its conclusions. Also, the use of the interview as a supplementary technique of data collection would have shed more light on the questionnaire terms that were capable of being misinterpreted by the respondents.

Based on Abdolmohammadi's (1991) study, Abdolmohammadi and Usoff (2001) examined the extent to which decision aids are perceived to be useful for

performing detailed financial audit tasks. By examining this area, the authors sought to present data already gathered from managers and partners in 1988 on the supposed helpfulness of various decision aids for performing detailed audit tasks and to present a list of detailed audit tasks for which at least 50% of the responses indicated usefulness of a decision aid in the 1996 data.

The study used a longitudinal research approach to collect data over a long period of time. A self-completion questionnaire instrument was used to collect data from managers and partners from the US offices of some international accounting firms. The findings indicated, for a majority of audit tasks, that highly experienced auditors (participants) assessed complete human processing as their preferred method for performing the task (79% in 1988 and 69% in 1996). This might be due to the expertise and experience this category of auditors might have acquired over a long period of practice. Besides, the older generations of auditors are more likely to be conservative by sticking to the old manual procedures that they trained in and used earlier in their working lifetime rather than exploring the computerised procedures to assess their impact on the efficiency and effectiveness of the audit tasks.

The study showed a thorough understanding and application of the longitudinal approach to research. The approach was consistent with the aim of the study, which was to examine the extent of the applicability of decision aids for detailed tasks in a financial audit over time. However, while the study seemed to be strong in the methodological approach, it clearly lacked any articulation of a theoretical underpinning, which ought to guide the framing of research questions and the methodology of data collection and analysis.

Bonner et al. (1996) scrutinised the effectiveness of decision aids in counteracting the difficulty an auditor encounters in applying experienced error frequencies to

judgements relating to the probability that an audit objective is violated given a particular transaction cycle. The study examined the effectiveness of a checklist aid (for knowledge retrieval) and a decomposition-and–mechanical-aggregation aid (for knowledge retrieval and aggregation).

Based on a computerised experiment involving 105 auditors from one of the then "big6" accounting firms, the result of the study indicated that the checklist aid (that provides the auditor with retrieval cues to recall and combine the frequency knowledge necessary to estimate conditional probabilities) slightly improved the degree to which an auditor's judgements reflected experienced frequencies, while the mechanical aggregation aid (that assists in both the retrieval and aggregation of component judgements) significantly enhanced auditors' judgement thereby eliminating the gap between knowledge organisation and task organisation.

In the case of checklists, while the study corroborated that of Butler (1985), its result is divergent from that of Pincus (1989) who was of the opinion that the use of checklists would not improve auditors' judgement. Similarly, in the case of the mechanical aggregation aid, the result of Bonner et al. (1996) reiterated the conclusion put forward by Libby and Libby (1989) while it negated those of Jiambalvo and Waller (1984) and Daniel (1988) who were of the view that mechanical aggregation aids decrease performance in audit risk assessment in terms of making correct audit judgement.

Although Bonner et al.'s (1996) study was able to provide a psychological insight into auditors' judgement vis-à-vis the use of decision aids, the methodology adopted for the study appears to be over-simplified. Certain human resource policies (regarding recruitment, training and promotion) of the "big6" firm used for the study might have had a considerable impact on the respondents, whereas a

more broad-based approach encompassing more audit firms of diverse size might have given the results a more widespread applicability.

Lowe and Reckers (2000) conducted an experiment in which 131 audit seniors from one of the then "big5" accounting firms participated to assess the use of foresight decision aids in auditors' judgements. The finding of the study signified that auditors' ex-ante decision process can be adjusted through the use of decision aids in such a way that their judgements become closer to those of ex-post (standards of conduct) evaluators. The study is the first to adopt foresight techniques to mitigate hindsight effects as it sheds more light on the impact decision aids can have on mitigating hindsight effects on auditors' assessments. The only weakness identified in the research is that the experiments were based on auditors at the same level of seniority from a single accounting firm, whereas it is possible that the research outcomes might have been different if the subjects' levels had been varied and if auditors from other large accounting firms had been used.

Bedard and Graham (2002) assessed the effect of decision aid design on auditors' identification of risk factors and audit test planning. The study's focus was unique as it concentrated on risk identification as opposed to risk assessment (that was obtainable in the literature as it was then). The specific areas of risk included in the decision aid used in the study were the client's accounting function, fraud, EDP security and management information quality.

The study indicated that auditors using negatively oriented risk identification decision aids document more risk factors than those using positively oriented decision aids particularly for higher risk clients. In addition, the study showed that greater risk factor identification often leads to increased substantive and total audit

tests as opposed to control tests. It also emphasised the central role decision aids could play in preventing losses arising from ineffective risk identification for high risk clients.

Although the sample size for the study was relatively small (46), the fact that the research subjects came from two of the then "big5" accounting firms who use more decision aids (in addition to controlling a large proportion of audit engagements) strengthens its validity. Also, the subjects were evenly distributed across the different ranks within the firms. Most importantly, the study made use of appropriate theoretical frameworks from the field of sociology such as the scheme theory (which postulates that negative information or perception from past experience affects expectations).

Rose and Rose (2003) conducted experiments using 258 auditors to consider the effects of fraud risk assessment and an automated decision aid on auditors' evaluation of evidence and judgements. The study was based on theories of suspicion in cognitive and social psychology to examine the effects of risk assessments on auditors' behaviour. The study's results indicated that auditors facing high levels of assessed fraud risk examined audit evidence more thoroughly than auditors facing low levels of assessed fraud risk. The former were also found to be more biased in their audit judgements than the latter. The study further suggested that auditors do have the tendency to focus more on the last evidence they receive during the decision making process (recency effect), whereas the use of an automated decision aid fosters consistency irrespective of the order in which pieces of evidence being considered appear.

Rose and Rose's (2003) study was able to meet its set research objectives and, with this, the study was able to break new ground by being the first study to

scrutinise the impact of fraud risk assessments on auditors' decision processes throughout the audit. In addition, the methodology adopted was suitable to the nature of the phenomenon being investigated, behaviour.

2.2.7.1: Decision Support Systems

A decision support system (DSS) is any system that serves as an aid to decision making (Gray et al, 1991). Based on functions and usage, Davis (1988) categorised DSS tools into three:

- business graphics, ad-hoc data query and spreadsheet analysis
- statistical analysis, ranking/choice decisions and project management
- resource allocations, risk/decision analysis, process simulation and distributed decisions

Today, it is possible for groups of various users from different locations to share programs, DSS tools and data resources. This has become feasible through the developments in local and wide area networks as well as distributed data processing (Gray et al., 1991).

Gray et al.'s (1991) study considered changes in information processing, expert system and decision support technology as they impact on auditing and the future implications thereof. Apart from contributing to the body of growing literature on audit automation, to a large extent, the study sheds more light on areas for further research concerning the use of decision support and expert systems as an integrated audit automation process and these suggested areas have been taken up in one way or another by subsequent researchers (as shown later in this section). These include Biggs et al. (1993), Lenard et al. (1995), Lenard et al. (2001) as well as Lowe et al. (2002).

In a study that involved a collaboration with partners of three of the then "big5" accounting firms, Lenard et al. (2001) proposed a hybrid system (that combines the

use of both statistical and qualitative information) as a decision support model for auditors' going concern assessment in order to improve the accuracy and reliability of such unstructured decisions. Earlier studies on this subject either represented the use of quantitative (Chen and Church, 1992; Lenard et al., 1995) or qualitative (Biggs et al., 1993) analysis but Lenard et al. (2001) believe such a hybrid model will be more reliable as it integrates the strengths of both qualitative and quantitative approaches to arrive at such a highly sensitive audit decision.

The proposed system evaluates four key problem areas of a client's business, which helps the auditor assess the required risk level in order to be able to determine what type of audit opinion will be most appropriate. These key areas are operations financing, economic conditions, past funding sources and future funding needs.

As audit focus continues to move gradually from system and transaction based auditing to risk based auditing, the study's contribution to the use of decision support systems in audits is significant. It advocated the use of both quantitative and qualitative information to arrive at a crucial audit judgement, going concern assessment. The model was pre-tested with the support of three of the then "big5" accounting firms. In addition, the study could not have been published at a more appropriate time considering the fact that the audit profession is coming under intense scrutiny as a result of auditors' inability to pre-empt the recent big corporate failures. A major drawback of the proposed hybrid model is that it would only be suitable for large audit firms and for the audit of large corporations because of its scale and complexities.

Greenstein and Hamilton (1997) advocated some critical factors necessary to consider in the development of a DSS to help auditors in making more informed

decisions concerning client acceptance/continuance as a way of avoiding litigation. The study was able to meet its stated objective which was to build upon the scanty literature existing at that time on audit client engagement. The research adopted a Delphi technique by gathering data from partners and senior managers from each of the then "big6" accounting firms with a view to solving a common core problem, audit client engagement decisions.

The study concluded that personal characteristics of a business's key executives are the single most important category of factors in determining the accept/continue/discontinue decision. However, it failed to provide an acceptable yardstick to carry out a subjective evaluation concerning an executive's characteristics.

Bamber et al. (1996) conducted a controlled research experiment on 25 four-person groups of practising auditors to assess the possibility of a Group Support System (GSS) in enhancing audit decision making. Based on a three phase experiment (with varying decision attributes) on one hundred advanced senior auditors, the result of the study indicated that group decision making increases consensus and produces a more robust problem-analysis compared to individual decision making. It also suggested that compared to traditional groups (face-to-face), GSS groups in problem analysis and group members display a higher acceptance of group decisions.

Bamber et al.'s (1996) study was a novelty in the schemes of literature on audit technology as it examined the potential benefits of GSS technology in audit decision making contexts which in most cases require multi-auditor interaction and frequently some geographic dispersion. However, the study is somewhat distant from the practical realities of audit decision making as the experiment solely made

use of audit seniors, a homogeneous group who would be expected to agree and reach the same conclusions as each other, whereas a typical audit decision is more likely to involve other levels of auditors especially consultants, specialists, audit managers and partners. Hence, a case study approach might have been a more appropriate method.

Lowe et al. (2002) put forward the idea that decision aids can have a positive, negative or neutral effect on an auditor's legal liability. The study conducted an experiment with the participation of 149 actual jurors and concluded that for high-reliability aids, auditors are more likely to be held liable if they override the recommendation of a decision aid than when they did not use the aid, while they are less likely to be held liable if they uphold the recommendation of a decision aid even when the aid turned out to be incorrect. However, when the reliability of the aid is low, auditors' use of the aid is not likely to have any impact on auditors' liability.

A major strength of the study is its ability to rank the reliability and effectiveness of auditing decision aids before assessing the effects of their use on auditors' liability in cases of fraud or corporate failure as earlier studies took their reliability and effectiveness for granted. Nevertheless, the cases presented to the jurors were hypothetical and the fact that there were no counsels present to clarify any ambiguous areas might have affected the findings. Apart from this, the method of determining the reliability or otherwise of a decision aid in real life situations might be more complex than presented in the study.

2.2.7.2: Neural Networks

A neural network is a form of artificial intelligence that attempts to mimic human brains. It comprises a set of interconnected units (processing elements) that

respond individually to a set of input signals sent to each. Neural networks are useful in making predictions based on a large database of past events and trends.

To assess the risk of management fraud, Green and Choi (1997) developed a neural network fraud classification model using endogenous financial data through the evaluation of analytical procedure expectations. This model was designed to prompt the auditor to carry out substantive testing as soon as any financial statement is classified as fraudulent. However, none of the currently accessible literature substantiates the proposed model.

Using a sample of 77 fraud engagements and 305 non-fraud engagements, Bell and Carcello (2000) developed a logistic regression model that predicts the possibility of fraudulent financial reporting for an audit client based on certain fraud risk factors such as weak internal control environment, rapid company growth, inconsistent relative profitability and management lying to the auditors or being covertly evasive among others. The result of the study indicated that the model was significantly more accurate than practising auditors in assessing risk for the 77 fraud engagements while there was no significant difference for the non-fraud samples. Although the model is likely to be effective given its incorporation of the fundamental risk factors, its use would be more relevant in large organisations than small and medium enterprises as a result of its complexities.

Lin et al. (2003) evaluated the efficacy of an integrated fuzzy neural network for assessing the risk of fraudulent financial reporting as an alternative to the existing statistical models and artificial neural networks. The study was able to achieve the objective for which it was carried out, that is, to investigate the effectiveness of information technologies such as an integrated system of neural networks and fuzzy logic for fraud detection. Apart from the fact that the model was more complex than ordinary statistical models or artificial neural networks, its

acceptability to practising firms remains uncertain as it might be too early to determine whether or not the proposed integrated fuzzy neural network could be effective in assessing the risk of fraudulent financial reporting.

2.2.7.3: Knowledge-Based Expert Systems

One of the earliest efforts at expounding the meaning of expert systems was made by the British Computer Society Specialist Group on Expert Systems. The group defined an expert system thus:

> *"An expert system is regarded as the embodiment within a computer of a knowledge-based component, from an expert skill, in such a form that the system can offer intelligent advice or take an intelligent decision about a processing function. A desirable additional characteristic, which many would consider fundamental, is the capability of the system, on demand, to justify its own line of reasoning in a manner directly intelligible to the enquirer. The style adopted to attain these characteristics is rule-based programming"* (As quoted in Connell, 1987:221).

Arnold et al. (2004) defined expert systems as software-intensive systems that combine the expertise of one or more experts in a specific decision area in order to provide a specific recommendation to a set of problems which assists the user in making a better decision than when unassisted.

A knowledge-based expert system (KBES) is an amalgam of system and process designed to imitate the judgements of experts. It is different from other computerised systems because it possesses peculiar attributes such as focus and application (Baldwin-Morgan and Stone, 1995).

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In the words of Eining et al. (1997:5),

> *"Expert systems differ from more traditional decision aids in two fundamental ways. First, they place emphasis on knowledge, typically generated as rules, rather than algorithmic solutions. Second, they provide access to this knowledge base to the user of the decision aid. In addition, sophisticated expert system software gives numerous capabilities for enhancing the dialogue between the user and the system".*

Connell (1987) suggested three broad criteria to measure the success of an expert system. These are:

i. The accuracy of their advice compared with that of a human expert
ii. The extent to which their use saves or makes money for the builders i.e. their return on investment
iii. The way in which they interact with the user in the presentation of their advice or explanation of why and how they are behaving as they are.

Hu (1987 as quoted in Baldwin-Morgan and Stone, 1995:600) outlined certain compelling circumstances that may make the development of KBES worthwhile. These include:

i. a shortage of human experts/specialists
ii. a need to preserve experts' expertise
iii. a high cost of expert advice or erroneous decisions
iv. routine, detail-dependent decision making.

As far back as the 1930s, early applications of artificial intelligence had centred around the manipulations of physical objects by program-controlled machines but these had few commercial or practical benefits. These limitations were addressed

by governments of different countries through certain collaborative efforts of both academics and industrialists. Examples are the Japanese Institute for New Generation Computer Technology and the British Alvey Programme both in 1982. The Alvey Programme focused on four broad research areas which included software engineering, very large-scale integration, man-machine interfaces and intelligent knowledge-based systems (Connell, 1991).

The research into intelligent knowledge-based expert systems enlisted the participation of large banks and accounting firms in developing an expert system, ALFEX. (ALvey Financial Expert System). Although the efforts on the Alvey Programme were truncated half way through, the experience and exposures gained by participating accounting firms proved useful for the European Community initiatives such as ESPIRIT. This initial experience also spurred these firms into developing in-house expert systems for different aspects of their professional practice (Connell, 1991).

Connell (1991) identified two stages necessary for the construction of an expert system. These are knowledge acquisition (from experts) and knowledge representation (suitable to trace the validity of the system's conclusions). Leech (2004) further breaks the second stage down into three. These are model development, computational modelling via computer software and validation of the model and the software.

Edwards and Connell (1989) researched into the use of expert systems by accountants in the UK, USA and Canada. The study showed that audit had the highest number of expert systems developed by accounting firms. The study also revealed that audit managers and supervisors are more likely to use expert systems than partners and trainees.

An effective KBES is expected to provide several benefits to the audit profession. These include understanding of task processes, increased knowledge and knowledge transferability. This explains why most accounting firms, particularly the large ones, are increasingly adopting KBES in several areas of their operations (Brown, 1991). A number of KBES in auditing have been identified as encompassing systems that support audit planning, compliance testing, substantive testing, opinion formulation and reporting as well as audit client engagement decisions (Gray et al, 1991; Greenstein and Hamilton 1997).

Eining and Dorr (1991) conducted an experiential learning research study using 191 upper level students of accounting to serve as novice audit decision makers in evaluating the adequacy of an internal control system with a view to investigating the impact of an expert system (ES) on experiential knowledge acquisition. The study revealed that of the four groups to which subjects were classified for the exercise (no decision aid, questionnaire, ES with no explanatory capability and ES with explanatory capability), participants allocated to the two expert system groups performed significantly better than the other two groups.

The study was based on a sound theoretical framework famous in educational psychology, the cognitive learning theory. This was combined with an appropriate methodology, controlled laboratory experiment and the result of the research provided one of the earliest insights for practising firms venturing into the use of expert systems for novice auditors.

Baldwin-Morgan and Stone (1995) proposed a two-dimensional framework (matrix model) to address the multiple possible impacts of KBES on accounting firms. This matrix comprised the levels of impact (industry, organisation, individual and task) on the one hand and the categories of impact (efficiency, effectiveness, expertise,

education and environment) on the other. The rationale for choosing different levels of impact was the fact that each type of task or industry might have unique effects caused by KBES. Baldwin-Morgan and Stone's study therefore provides a useful framework for studying ICT's impact on accounting practice as it takes into consideration some necessary peculiar contingency factors (task, industry, environment and size).

The study was able to present a model to assess the impacts of expert systems on organisations and individuals that use them and this is totally unlike what is found in most prior studies which only discussed how KBES works and why they have been developed or at best their potential impacts on audit. The model was grounded in previous empirical studies on the impact of audit expert systems and management accounting expert systems available in the current literature (Yamasaki and Manoochehri, 1991; Baldwin-Morgan, 1993; Brown and Phillips, 1990). The study therefore combined a sound theoretical model with empirical insights. Below is the KBES impacts matrix model proposed by Baldwin-Morgan and Stone (1995: 602):

CATEGORIES OF IMPACT	LEVELS OF IMPACT				
		Industry	Organisation	Individual	Task
	Efficiency	Industry productivity	Organisational productivity Decision distribution	Individual productivity	Personnel productivity Task unit characteristics
	Effectiveness		Product quality Customer satisfaction	Individual effectiveness	Task quality Consistency Completeness
	Expertise		Distribution	Inhibition v. Expansion	Preservation Documentation Insight Complexity
	Education	Continuing Professional Education	In-house training	Educational preparation	Task training Learning curve
	Environment	Competition Litigation De-humanisation Prestige Ethics	Business risk Capital Prestige Litigation Employees Billing	Litigation Employment Ethics	Task related risk Task process

Table 2.3 KBES' Matrix Model [Baldwin-Morgan and Stone (1995)]

Eining et al. (1997) suggested using decision aids in the complex decision process of assessing management fraud risk. The study adopted a laboratory experiment approach on ninety-six auditors to examine the use of an expert system to enhance the engagement of the user. Compared to the use of checklists and a logit statistical model which provides only a suggested assessment, the study's result indicated that the use of expert systems enhances auditors' ability to better discriminate between circumstances with different levels of management fraud risk. Therefore, expert systems appear from this study to be the most technologically

advanced and provide a higher level accuracy device in assessing management fraud risk.

The study is one of the few that compared the impact of three decision aids (checklists, statistical models and expert systems) in auditors' assessment of the risk of management fraud. Also, while the study's incorporation of a constructive dialogue mechanism in using expert systems further advances knowledge in the area, its use of a laboratory experiment might not have presented a realistic perspective of the phenomenon being studied especially since it was a one off exercise. In addition, using a single highly structured firm of a "big6" status might not form an adequate basis from which to generalise the study's results.

Swinney (1999) examined the reliance on expert systems developed to assist auditors in evaluating loan reserves by one of the then "big6" accounting firms. The research was grounded in previous studies, which "*have reached decidedly contrary conclusions supporting both under-reliance and over-reliance on expert systems*". Therefore, Swinney's (1999) research addressed two research questions within the social context of the accounting firm. These are:

i. Do auditors overrely on expert system output in forming their own loan loss reserve judgements?
ii. Do auditors overrely more on negative expert system output than on positive expert system output in forming their own loan loss reserve judgement?

Swinney (1999) drew from relevant theoretical and empirical arguments about organisational social context and factors that might lead to under/overreliance on expert systems by accounting firms. Two hypotheses were developed from the arguments. In the first hypothesis, Swinney (1999) sought to examine how "*the*

loan loss reserve judgements made by auditors following consideration of erroneous negative system output are the same as the loan loss reserve judgements made by auditors following consideration of erroneous positive expert system output". The second hypothesis examined how the loan loss reserve decisions by auditors following consideration of mistaken negative expert system output, the loan loss reserve decisions made by auditors following consideration of incorrect positive expert system output and the loan loss reserve decisions made by auditors who do not consider any expert system output are all very similar.

The study made use of a laboratory experimental research method to collect empirical evidence to test the hypotheses in a small case study sample while data collected were analysed using non-parametric statistical tests. The findings supported overreliance on expert system output and greater influence of negative expert system output. The study showed sufficient grasp of the issues involved in the study by drawing parallels between the theoretical and empirical debates and the findings of the study. The paper also suggested that future studies should consider an extension of the research to include the use of multiple cases with real audit file data, including both adequate and inadequate reserves.

As identified by the author, Swinney (1999), the sample size of just 29 auditors appears rather limited for a study of this importance. Besides, since actual output from a working expert system developed by one of the then "big6" accounting firms was used for the participants in the study (from three different firms), there is a possibility that some of the participants were already familiar with the expert systems used in the research. This raises a possibility of bias and may have affected the results.

Arnold et al. (2004) assessed the impact of decision aids on expert and novice decision-makers' judgement. The study indicated that an appropriate combination of user and aid may improve the expert decision-maker's decision quality but the

novice decision-maker may be susceptible to poorer decision-making if intelligent decision aids are more expert than the user. The research adopted an experimental approach on two groups of expert and novice insolvency practitioners using a decision aid called INSOLVE (Leech et al., 1998).

The study was able to blend practice with relevant technological and social theory to fulfil the modest aim it set out to achieve. However, a post-mortem investigation of real life decision-making using INSOLVE would have been closer to reality than the experimental techniques used in gathering data.

Dillard and Yuthas (2001) introduced an entirely new perspective to the impact of expert systems use in auditing by considering ethical issues inherent in the business application of KBES in audit practice. The study adopted Niebuhr's theory of "the responsible self" to underpin the scope of what constitutes an ethical issue and as a framework for identifying responsible action which is expected to always consider ongoing interactions among the stakeholder groups affected by the implementation of expert systems. The study also put forward the idea that the frame should be used to evaluate the actions before the development of the system side by side with the potential consequences for the system.

As financial audit is essentially a series of linked decisions each requiring professional judgement, it would be a complex and difficult task to develop one complete financial auditing expert system with current technological capabilities, accounting firms and researchers are compelled to develop expert systems for various narrowly defined audit domain tasks. Nevertheless, Gray et al. (1991) predicted a composite meta-level expert system with the aid of emerging techniques such as blackboards to share information between the individual expert systems given the on-going evolutionary advancement in technology.

2.2.8: Continuous Online Auditing

The worldwide awareness and increased adoption of the internet by corporate organisations for public relations and advertisement purposes in the mid 1990s stimulated research efforts on the extent of use of the Internet by listed companies (Petravick and Gillett, 1996; Lymer, 1997; Gowthorpe, 1999). Furthermore, recent efforts have focussed on reporting practices such as the use of webcasts and e-mail alerts to reach investors, the formats used for posting annual reports and accounts on the Internet and its use for online real-time stock quotes by corporate entities (IASC, 1999; FASB, 2000; Allam and Lymer, 2003). As the nature of an entity's financial accounting and reporting system determines the audit approach that will be appropriate, the increasing trend in Internet financial reporting is bound to stimulate interest in online auditing to provide a form of assurance to investors and other stakeholders particularly within the framework of listed companies.

Otherwise referred to as real-time, concurrent or "lights-out" auditing, Continuous Online Auditing (COA) is a comprehensive electronic process that enables auditors to provide some degree of assurance on continuous information simultaneously with, or very shortly after, the disclosure of the information. It covers all the three professional services commonly provided by independent auditors, that is, assurance, attestation and audit services (Rezaee et al., 2002), achieving this through Real Time Accounting (RTA) systems. Its key constituents are continuous audit of database applications, data capture procedures, systems audit and real time analytical procedures (Kogan et al., 1996).

Under COA, the auditor could employ audit software to find out irregularities in data files of detected transactions such as payment of the same invoice number twice. Embedded Audit Modules (EAM) can be used to provide real-time notification of a range of occurrences (Helms 2002). However, Debreceny et al. (2003) suggested that the current limitations of this predecessor technology to COA, the EAM, must necessarily be addressed before COA can be widely acceptable in the audit world.

Also, Helms (2002) explained the relevance of digital agents which could be reactive (filtering incoming information) or proactive (searching the system for the occurrence of certain pre-specified conditions). However, the study raised a genuine concern with regards to the extended interaction between the auditor and management during the process of the design and implementation of COA tools (such as embedded audit modules and digital agents) which may raise concerns on auditor independence.

The rapid growth of online retailing, online security trading and procurement systems in relation to the perceived need for more timely assurance for an organisation's systems and control by the various stakeholders has led to the concept of continuous auditing (Kogan et al, 1999). The concept has been made feasible with the developments in digital telecommunications. However, the study put forward the idea that the technological feasibility of COA rests on computerised accounting information systems and ubiquitous computer networking.

COA can lead to the issuance of audit reports on a short interval basis (daily, weekly or as immediately as feasible). The Canadian Institute of Chartered Accountants (CICA, 1999) categorised auditors' reports in an online real-time situation into two: the 'evergreen reports' which are usually made available whenever a user accesses an electronic site containing it: this will be dated at the time of user access; and the 'reports on demand' which would only be accessible to a user on request rather than being automatically available.

However, frequent misstatements, and the time required for resolution, may delay audit reports and diminish the usefulness of COA. According to Shields (1998), these hurdles may be overcome if certain conditions are met: a reliable information system, a high level of automation of the system, an effective link between the auditor's system and that of the auditee, timely availability of accurate audit reports and the auditor's proficiency in using the technology. Continuous testing

techniques are much more relevant in systems that produce electronic audit trails such as computerised accounting information systems. Continuous monitoring would allow the auditor to adopt a lower control risk methodology as transaction data might be retained only for a limited period of time (Shields, 1998).

The extent of automation in COA depends largely on audit system design and implementation. The highly automated processes entail EAM whereby audit programs are integrated with the application source code to constantly monitor and report significant audit events (Helms 2002). On the other hand, the less automated processes may entail an ability to automatically capture, transform and load data but will still require the auditor's intervention to run queries with a view to isolating exceptions and detecting unusual patterns (Rezaee et al., 2002).

The auditor can make use of audit software to discover anomalies in data files of deleted transactions. Digital agents, too, can be used to search the system for the occurrence/existence of certain pre-specified conditions such as an order exceeding a certain amount of money. Similarly, EAM can be used to provide real time notification of a variety of events. In case of the occurrence of any significant discrepancies, alarms would be triggered for necessary actions by the management and the auditors. In addition, the auditor could obtain operational data made available by 'sensors' and carry out analytical review procedures to make a comparison between expected results and recorded amounts (Kogan et al., 1996).

Searcy and Woodroof (2003) enumerated six basic components required for the successful implementation of COA. These are the web servers (auditors have controlled access to the client's database and allowing approved third parties limited and controlled access); the continuous audit environment; the continuous audit agreement (contract between the parties concerned); the continuous audit (dependent on the reliability of the connected systems with integrity, security,

availability and maintainability); transmission of information (with confidentiality, integrity and authentication) and evergreen reports.

Audit techniques such as the snapshot approach and the systems control and audit review facility (SCARF) are predicted to receive increased attention and use under COA in testing the effectiveness of the auditee's internal control structure (Rezaee et al., 2001). Also, it has enhanced the reliability of real time financial statements being made available for financial transactions on stock exchange markets. The operational significance of COA lies in the gradual growth in its adoption by most Computerised Information System based organisations across the globe. It is in the realisation of this fact that the Canadian Institute of Chartered Accountants (CICA, 1999) identified electronic commerce as the first area of business where COA might be of tremendous benefit.

COA can be useful as a modern auditing technique in two ways. It has both detective orientation (ex-post) and preventive orientation (ex-ante). The first orientation serves a similar purpose with the traditional audit of examining 'historical' records and books of account to derive audit evidence, whereas the latter can serve as a barrier to the occurrence of errors and frauds with the use of sophisticated ICT tools and techniques. These can be greatly enhanced through the design and use of appropriate artificial intelligence to function as Continuous Intelligent Online Validation (CIOV) (Helms, 2002; Omoteso et al., 2003).

Under conventional audits, certain bottlenecks are encountered. These include the requirement of follow up, low expectation on control environment trend and frequent audit visit each time an audit opinion is needed. However, under COA, control failures are rectified as they arise, assessment of the strength of the control environment is improved and the audit opinion is always available whenever required (Handscombe, 2003).

There has been an increase in the use of the Internet for disseminating financial information. US companies are currently taking the lead in this respect while their European counterparts are equally following suit as current legislation allows companies to meet their statutory financial reporting obligations (which include the auditor's report) to their shareholders to include posting the reports on the company's website and advising shareholders that this has been done (Beattie and Pratt, 2003) as this will be quicker, more cost effective and more convenient for all parties. Also, Searcy and Woodroof (2003) suggested that COA would be able to take care of the wastages commonly associated with the traditional audit process. These include overauditing, delay in data accessibility, time delay, cumbersome process, errors and mistakes.

Higson (2002) predicted that COA would possibly be a new generation of audit (fifth) following Davis's (1996) description of four audit generations as:

i. verifying transactions in the books
ii. relying on systems
iii. risk-based
iv. investigatory

Furthermore, Higson (2002) advocated that it would be more appropriate for COA to be carried out by internal auditors because of its nature and logistics. In line with Higson's view, Voarino and Vasarhelyi (2002) examined a bank's internal continuous assurance process which is meant to provide management and stakeholders with a comprehensive assurance of the reliability of financial and operating information through a set of complementary activities that includes online internal risk monitoring. This, the authors believe, would be able to meet the challenges of the rapidly growing banking environment, regulatory authorities' requirements and the structure of banking corporations. This study buttresses Higson's view on the usefulness of COA to the internal audit function.

Kogan et al. (1999) examined the growth of the evolving field of continuous online auditing. The study mapped the historical development of the use of computers in accounting and auditing by identifying the factors, institutions and technological developments that shaped the use of online auditing over the years.

The study is exploratory as it identified the factors, institutions and technologies responsible for COA's development and the risks involved in its use. The study also discussed the feasibility of COA and traced the different research, empirical and statutory efforts on the subject. Apart from historically mapping the areas of development and using case studies from different areas where COA had been used, it raised important questions about the risks involved in its use. The authors therefore concluded that widespread availability of computer networking makes it possible to dramatically increase the frequency of periodic audits by redesigning the auditing architecture around online auditing.

Although the study was highly descriptive and lacked empirically based case studies, it was one of the pioneering works in the area of COA and it served as the springboard for further research efforts in the area as it highlighted a number of perspectives on the current and future implications of using the mechanism by practising auditors as well as the management of corporate organisations. Examples of further studies that were based on Kogan et al.'s (1999) suggestions are Vasarhelyi (2002) on a series of research issues that might enhance the conceptualisation of modern assurance processes; Alles et al. (2002) on the feasibility and economics of continuous assurance; Orman's (2001) 'counting and periodic' audit strategies; and Pathak et al. (2005) on 'counting and time dependent' strategies for minimising the cost of continuous audit in assessing the economic feasibility of COA.

Rezaee et al. (2001) predicted that the exponential growth in technological advancement (especially as it relates to Extensible Business Reporting Language

(XBRL) being gradually built into accounting software) might lead to online real-time preparation, publication, examination and extraction of financial information. The study discussed continuous online auditing and its implications for independent auditors and examined internal control in the volatile ICT environment.

The study was of the view that clients' records being in electronic form do not change the primary objective of financial audit and generally accepted auditing standards, rather it is just the procedure that would have to change and in situations where a real time accounting system is adopted by a client, then COA becomes imperative if the audit is to be effective.

In a related article, Rezaee et al. (2002) attempted to discuss the nature of COA and described audit data warehouses and data marts as audit approaches in a real time business environment. The study advocated four fundamental requirements for auditors under a COA system: an increase in the auditor's knowledge of the client's business and industry; comprehensive understanding of the flow of transactions and control activities; employing a control-risk-oriented audit plan and developing their own software audit tools that are capable of auditing through the computer.

Both Rezaee et al. (2001) and Rezaee et al. (2002) provided useful insights into the workings and relevance of COA for twenty-first century auditors. Also, the two studies identified the potential implications of COA and initiated areas of exploration for future research. Nonetheless, the realities of some of the ideas put forward are yet to unfold as the usefulness of COA's capabilities to auditors and their clients is yet to materialise fully in the business world.

Lymer and Debreceny (2001) mapped the growth of online corporate reporting through earlier propositions and arguments presented by academics and other concerned groups. The study also examined the general pronouncements from

professional bodies released in the US, Australia and the UK relating to auditing online reporting in the light of academic studies mapped. The study concluded that of the three countries, Australia had the most developed pronouncements (through AGS 1050 of 1999 and AGS 1056 of 2000) on the role of the auditor with regards to online reporting.

While the study was able to suggest areas where further research would shed more light on the wider implications of the impact of online reporting and the role and output of the audit function, it failed to consider the peculiarities of each of the countries examined with respect to their socio-political, legal and technological environments. Furthermore, in a related study, Lymer and Debreceny (2003) concluded that although various audit standard bodies around the world recognised the need for a more structured guidance to auditors on the implications of Internet financial reporting, the response of these bodies was yet to be adequate.

Kogan et al. (1996) considered the implications of the growing internet technology on auditing in terms of its opportunities and threats. While the study identified the facilitation of continuous control and monitoring potentials as well as the propensity for enhanced and multi-layered reporting as the main prospects, it emphasised security risk concerns as the main threat. It therefore suggested cryptography as a veritable technology that would be able to secure information flow on the internet with respect to confidentiality, integrity and authentication of electronic transactions. The study was able to make an original contribution to knowledge by critically assessing the impact of Internet technology with respect to its opportunity and threats in an online financial reporting and auditing environment.

Alles et al. (2002) identified two opposing approaches in implementing continuous online audit. These are continuous monitoring of the client's system and continuous review of the processing of the entire client's information using a mirror

system which enables it to record transactions at the same time as the firm. The study further argued that the more comprehensive the continuous online auditing system becomes, the closer the relationship between the auditing system and the audited system will be placing a question mark on auditor independence. The development of an effective COA system requires both the intimate knowledge of the clients' system and the cooperation of that system's developer (Alles et al., 2002). The study therefore posited that auditor independence might be affected as clients' systems progressively become more and more integrated with auditors' and auditors play advisory roles to their clients on the design of and changes to internal controls.

Furthermore, the study casts doubt on the proposition that the overall cost of implementing COA will decrease in the future as the authors believe that even though the hardware components of COA might become cheaper, the main software components as well as the labour costs for consultants involved in installation and regular maintenance of the systems are likely to increase as a result of the competitiveness of their services.

Pathak et al. (2005) advocated counting and time dependent strategies for minimising the cost of continuous audit in assessing the economic feasibility of COA. Building on the works of Orman (2001), the study extends Orman's analytical technique by including error and cost minimisation approaches with Orman's 'counting and periodic' audit strategies. The study posited that the counting strategy (where an audit is alarmed after a number of transactions have entered the system) was more cost-effective than the periodic strategy (where an audit is alarmed after a certain amount of time has passed).

Vasarhelyi (2002) considered a series of research issues that might enhance the conceptualisation of modern assurance processes. These were presented in the

form of a chain of nine normative and conceptual propositions towards auditing. These comprise:

i. The continuous assurance model with many clients (stakeholders such as investors, creditors, customers);
ii. The continuous assurance model with different independence considerations as the auditor is bound to have access to the client's systems and sometimes takes a part in the systems development and implementation process;
iii. The continuous assurance model with different justifications as demand for the audit function might come from any of the stakeholders for diverse reasons;
iv. The continuous assurance model with an element of strategic monitoring and relating this to actual operational factors;
v. The continuous assurance model that would turn the audit process into audit by exception as there would be a high degree of reliance on monitoring agents designed to detect exceptions in terms of system failures, errors or fraud;
vi. A new set of analytics that guides strategic monitoring. These would be less limited to financial indices and place more emphasis on process equilibrium and continuity;
vii. The continuous assurance model that covers a wider set of quantitative and qualitative non-financial data;
viii. The continuous assurance model with alternate materiality considerations as the audit focus is shifting to system reliability and non-financial data and
ix. The continuous assurance model which allows reporting on more futuristic information as the audit assurance opinion incorporates other facets of organisational performance.

The study also identified four technology-driven issues that can be used to facilitate, manage and assure business processes. These are internetworking, digitalisation of transactions, intelligent agents and improved analytics. The research areas spurred by the study are of great importance to the future benefits and potential constraints continuous online audit might have.

Greenstein and Ray (2001) explored the impact of web-based e-business activities on client firm processes and accounting methods. The study presented an e-business model, the customer-oriented value chain, to frame the discussion of emerging accounting issues arising from new digital business practices. The study therefore developed 16 fundamental propositions regarding possible methods accounting firms may consider for aligning traditional assurance with client firm e-business activities and better integration of current assurance practices. Some of the propositions affect certain accounts and the need for consideration of the information needs of trading parties while others are broad-based.

Furthermore, the study proposed a prototype for restructuring accounting firms towards effective integrated assurance services that incorporates transaction processing integrity, internal control assessment, real-time monitoring of systems and timely reporting of financial data.

Greenstein and Ray's (2001) study can be criticised (by audit professionals) for lacking currency as some of its propositions are already in operation in one way or another particularly in the large accounting firms. Also, some of the propositions lack market relevance as most corporations have no design for them and any attempt to embark on them by accounting firms might have serious economic consequences on their operations due to their capital intensiveness (Johnson, 2001). In addition, further research would be required to test the usefulness, relevance and efficacy of the theoretical propositions.

Wilks (2002) found out from an experiment involving audit managers of one of the then "big6" firms that the disclosure of the supervisor's views earlier in the audit review process increases subordinates' tendency to agree with those views because the subordinates unconsciously interpret evidence in a way that would be consistent with their supervisors' views. The incidence of subordinate agreement could be worse in a real-time audit review as subordinates are bound to have access to their superiors' views prior to their own evaluation of the audit evidence.

While this study was able to shed more light on the impact a real-time audit system might have on junior auditors' distortion of evidence especially when the supervisor is unaware of the implications their expressed views are capable of having in the juniors' decision process, the author's inability to use real partners in the latter experiment might have had a direct impact on the outcome of the study as the experiences and capabilities of the senior managers substituting for the role might not have been adequate.

From the Internal audit perspective, the American Institute of Internal Auditors (IIA) Research Foundation (2003) sponsored research that was published under the title "Internal Audit Use of Continuous Auditing: Current Use and Future Potential". The research adopted an online questionnaire technique to gather data from 160 internal auditors and the results indicated that the majority of the respondents showed interest in continuous auditing even though they believed they lacked training and skills to implement this practice in their organizations. Cost was also identified as the main factor militating against COA's wide adoption by internal auditors.

A major limitation of the study is the fact that the research subjects were volunteers who knew the research focus before consenting to participate. This might have overexaggerated the high level of desire for COA as its result indicated.

Nevertheless, this IIA research effort serves as the most comprehensive and recent body of knowledge and practice on COA as it relates to internal audit so far.

2.3.0: Theoretical Frameworks

Based on the evidence obtained in the literature, this study considers and adopts three theoretical frameworks as useful for the understanding of ICT's impact on auditing. These consist of the contingency, the socio-technical and the structuration theories as discussed in the following sub-sections.

2.3.1: Contingency Theory

The cornerstone of the contingency theory is a heuristic notion that discourages managers from seeking universalistic solutions and peddling panaceas (Wood, 1979). Contingency theory attempts to explain structural and process differences among organisations with respect to their operating environment, technology, size, strategy and culture among others (Scott, 1987; Xiao et al, 1996). The theory is based on three broad principles. These are:

- There is no one best way to organise
- Different ways to organise are not equally effective
- The best way to organise depends on the nature of the environment to which the organisation relates (Scott, 1987; Bartol and Martin, 1994).

Legge (1978) made a distinction between 'positive' and 'normative' dimensions to contingency theory. Similar to the concept of structural functionalism, the former dimension stresses "*that it is contingencies in the organization's environment that influence the organisation's internal structures and processes*" (Legge, 1978: 97). The latter however emphasises the importance of managers structuring their organisation within the context of its operations based on the peculiar situations of the organisation.

Legge (1978) proposed that these two dimensions should carefully be combined when using the contingency theory to arrive at the most fitting conclusions. According to his view, the positive dimension will enhance complex academic analysis and model building while the normative dimension will be helpful in the selection of contextual variables.

Burns and Stalker (1966) argued that it is a paramount responsibility to evaluate the economic and technological situations with respect to instability or the rate at which conditions are changing, and based on this assessment, create a suitable management system fitting to the conditions.

Bowey (1976) advocated the combination of 'systems' and 'action' theories as crucial to meaningful conclusions on studies involving contingency theory. The two proposed approaches, she claimed, would make such conclusions relevant to employees' behaviour in an organisation.

Sabherwal and King (1992) applied a contingency approach to present the decision processes involved in the strategic applications of information systems (IS). The study focused on the relationship between process attributes and contextual factors (IS function and external environment). It considered this relationship as a basic requisite for the management of the decision processes.

Using contingency and institutional theories, Gupta et al. (1994) examined how professionals in an institutionalised environment are coordinated and controlled and what forces shaped the structures organisations adopted for this coordination and control in 96 audit teams in the US General Accounting Office (GAO). They argued that the coordination and control of members was shaped by the task environment and the technical nature of the work they performed while the organisation's need to demonstrate conformity to institutional expectations of rational practice influenced its choice of control and coordination mechanisms in

institutional theory. Their findings indicated that the more institutionalised the environment, the more the organisation relies on a bureaucratic mode of control; the greater the task difficulty and team interdependence, the more the organisation relies on personal and group modes of control.

Schoonhoven (1981: 350) put forward the idea that contingency theory is not a theory 'in the conventional sense of theory as a well-developed set of interrelated propositions'. Rather, it is more an 'orienting strategy or meta-theory, suggesting ways in which a phenomenon ought to be conceptualised'. Schoonhoven (1981) argued that even though the overall strategy embedded in the theory is clear, its substance is not.

Wood (1979: 342) summarised the criticisms levelled against contingency theory by a cross section of its antagonists as "the problems of goal conflict, multiple contingencies and the existence of different parties in an organization" which he reckoned proponents of contingency theory had tackled by suggesting making organisational objectives one of the contingencies (Legge, 1978) and using action theory (which emphasises motivating individuals to act appropriately) as the basis of contingency theory rather than the structural functionalism perspective which emphasises function, interdependence, consensus and equilibrium (Bowey, 1976).

In spite of its criticisms discussed above, the contingency theory has served as a unifying and important framework for explaining organisational performance and attainments as well as the reactions or sensitivity of business organisations to certain forces (Kast and Rosenzweig, 1974).

2.3.2: Socio-Technical Systems Theory

As far back as the beginning of the second half of the last century, many writers - practitioners and academics alike have written on the social and economic implications of ICT. However, up to the 1990's, these writings and contributions

were not well aligned as a result of the absence of multi-disciplinary efforts and the rapid pace of advancement that characterises ICT (Dutton, 1996). Towards the end of the twentieth century, although the significant wave of ICT revolution was undoubtedly acknowledged, its driving forces and social implications continued to generate controversies (Dutton, 1996).

Social research on ICT revolves round different actors and contexts. Negroponte (1995) expounds social dimensions of technological developments and innovations by positing that both social and technological innovation affects the course of change in an irregular way.

Schumpeter's techno-economic waves theory (which states that economies undergo periodic and wrenching transformations every 30 – 40 years) has been reinforced by the shift from oil-based mass production to ICT which can snowball into economic and export growth. This has resulted in both job destruction and creation. Nonetheless, the job creation effects of technology change outweigh the job destruction impact (Freeman (1996). According to Freeman, the employment effects of ICT can be direct (manufacturers of computers, software, etc) or indirect (additional new services generated by the developments in ICT).

Both classical and modern economists seem to agree that technical change destroys old jobs and at the same time creates new ones. This duality raises concerns over the precise nature of the shifts that take place in employment characteristics. The central argument about the dual-edged nature of technical change was stimulated in 1821 by David Ricardo who wrote:

> *"The opinion entertained by the labouring class that the introduction of machinery is frequently detrimental to their interests is not founded on prejudice or error but conforms to the correct principles of political economy".*
>
> (as quoted in Freeman (1996: 20).

According to Wilson and Sangster (1992), the effect of ICT on accounting has been to increase the overall level of professional employment but marginally decrease the overall level of clerical employment.

Collier (1984) found unanimous agreement that the demand for clerical staff has fallen, while that of accountants depended on factors such as economic prosperity. Carr (1985), however, was optimistic for qualified accountants since new jobs such as systems auditor would be created. Collier (1984) also noted the change in the role of accountants from accumulation, analysis and preparation towards interpretation, evaluation, control and involvement in decision making.

The socio-technical system theory postulates the significance and distinctiveness of the role of human actors vis-à-vis other needs within an organisation. The foundation of the theory is the proposition that there should be an optimisation of both individual and task needs when designing work processes (Walton, 1999).

The concept of 'technological determinism' (whereby technology is assumed to play an overwhelmingly constructive role which could determine the development of social structure and economy) is still very much relevant in understanding society's perception of the way technology works. Little wonder then that society expects an unattainable level of performance by the auditors just because they use ICT for their audits. Otherwise known as the technological imperative paradigm, this school of thought posits that ICT is a material cause and a key driver of change that is able to automatically alter organisational structures and social contexts (Davis, 1989; Hiltz and Johnson, 1990; Applegate, 1996).

On the other hand, current efforts by the proponents of 'social shaping of technology' and 'social construction of technology' paradigms are likely to shift the public's attention and thinking towards social appreciation of technology by grounding technology in its social surroundings and addressing the real context in

which technology is situated. This school of thought perceives ICT to be a product of human action rather than an objective external constraint. It believes that the organisation's social contexts are the main driving force of adoption and use of ICT. This school insists that human actors within a social context (such as a business organisation) determine the what, when, how, where and who regarding the utilisation of ICT in organisational processes and procedures (Davis and Taylor, 1986; Wynne, 1988).

From a social construction angle Fischer (1996) argued, based on Berger and Luckmann (1966), that the construction of social phenomena are best understood in terms of an ongoing dialectical process comprising three moments: externalisation (actions shaped by the imperative of social actors' daily lives), objectivisation (actions are interpreted as an external objective reality) and internalisation (objectified reality "retrojected into consciousness" to regularise and rationalise the social actors).

However, neither of the two paradigms can sufficiently explain the impact of ICT on work (audit) as technology continues to foster a symbiotic relationship with social forces and the borderline between the two continues to be blurred as this interaction grows. Hence, the only feasible paradigm remains a holistic one that maintains a proportionate balance between technology and social forces, the socio-technical system theory, which this study intends to use as used in Orlikowski (1992).

A system is an organised assembly of resources and procedures united and regulated by interaction or interdependence to accomplish a set of specific functions. Thus, a system theory is related to the organisation of parts to form a coherent and effective whole (Martin and Dobson, 2005). The socio-technical systems theory therefore postulates why and how human and technological systems should be combined to produce an impact in the forms of quality,

space while system integration is the reciprocity of actions between agent or collectives across time and space. The structuration theory rejects the idea that structure and interaction are separable. It advocates that the duo should be considered as both the medium and the outcome of each other. (Giddens,1984: 28).

The theory proposes three properties of a social system. These are structure (rules and resources that can be classified as signification, domination and legitimation), modality (means to translate structures into actions i.e. interpretive scheme, facility and norm) and interaction (activity instantiated by the agent i.e. communication, power and sanction) (Giddens, 1984: 29). Giddens expatiated further that rules are techniques and generalisable procedures inherent in producing any social practice (examples are communication codes, linguistic rules, technical directives and organisational norms) while resources are capacities to generate commands over material objects and abilities to direct human activities) that members draw upon.

The role of ICT in organisations is perceived differently from study to study. While the presumption that ICT is the motivator for organisational changes prevails in the information community (Orlikowski, 1992; Caglio, 2003), many researchers provide a moderate view of the role of ICT in promoting organisational change (Martinez, 2002). Researches conducted by Jordan (1994) and Grover and Segars (1995) investigated the relationship between organisation characteristics on the one hand and information strategy and information system structures on the other hand. The thrust of these research works was that the use of ICT is always based on the needs of an organisation and the nature of information systems varies depending upon the particular form taken by the organisation.

Information is intimately linked to power-knowledge. Culture, control and competition as the constitution of subjectivity determine the locus of ICT development and applications in the organisation (Coombs et al., 1992). ICT does

not determine organisational forms and labour processes; rather ICT often reproduces complex political processes (Knights and Murray, 1992).

The major contributions of ICT to organisations are still viewed as improved efficiency through speed of processes and quality of service, organisational boundary spanning and coordination of the relations among organisational units. ICT is often the catalyst for reengineering projects that result in greater outsourcing and leaner internal staffing. As a general result, firms investing heavily in ICT are significantly smaller in staff size while holding other measures of size (e.g., revenues) constant (Martinez, 2002).

Layder et al. (1991) in a study of the empirical correlates of action and structure investigated the impact of individual and structural variables on movement into the labour market and the way the variables combine to determine entry into labour segments. The study suggests that structural and individual factors are influential at all levels of the occupational hierarchy, but that the strength of influence varies at different points in the hierarchy. Hence, structure and agency are deeply implicated in each other in the process of social reproduction. It could therefore be argued that in gaining insights into the effectiveness of audit automation, both variables could be taken into consideration in research design.

Coopey et al. (1998) identified managers' innovation as one of the factors that could influence the structure of organisations. Using data collected through interviews with managers in three organisations, they argued that an organisation's openness to its external environment allows for conflicting interpretations of necessary action. However, managers' capacity to transform circumstances in the desired direction depends on the extent to which they can deploy personal and organisational resources to negotiate appropriate meanings through social and political relationships with relevant others. Where the managers successfully negotiated appropriate meanings and their working innovations are

institutionalised, the existing structures and system are modified in ways that transform the behaviour of all those involved.

As discussed previously, the use of ICT in auditing presents huge challenges to the organisational forms or structures that will make audit automation effective. The challenges bear on theoretical debates on the roles of agencies and structures in organisations as well as debates on the use of a contingency approach by organisations undergoing significant transformation such as the one presented by audit automation.

To further demonstrate the relevance and significance of the structuration theory in studying and understanding ICT application in business operations, Dillard and Yuthas (2002:1) posited that:

> *"Structuration theory has been employed in various aspects of the organisational literature. Ranson et al. (1980), Pettigrew (1985, 1987), Barley (1986), and Willmott (1987) propose it as a basis for studying organisations. Barley and Tolbert (1997) propose it as a means of enriching and extending institutional theory. Orlikowski (1999, 2000) and De Sanctis and Poole (1994) and Dillard and Yuthas (1997) employ it to study information systems and their application within organisations. Roberts and Scapens (1985), Macintosh and Scapens (1991, 1992) and Macintosh (1994, 1995) discuss structuration theory and its employment in conjunction with studying accounting systems in organisations".*

Furthermore, Manson et al. (2001) applied structuration theory within the frame of the concepts of culture, control and competition propounded by Coombs et al. (1992) to the understanding of the impact of information technology on professional audit firms while Dillard and Yuthas (2002) illustrated how the theory could be used to frame the ethical consideration of advanced information technology applications

in business organisations. Combining structuration theory with the responsibility ethic and stakeholder theory, Dillard and Yuthas (2002) proposed a three-pronged approach to investigate the ethical issues and organisational process associated with the application of expert systems in professional audit firms. They argued that structuration theory provides a theoretical framework for articulating and investigating both the structures within which action is carried out as well as the interaction between the social structures and the actors; the application of stakeholder theory is a means for identifying affected constituencies; and a responsibility ethic recognises the situation of an individual within an ongoing professional community.

The study progressed from earlier works of the authors that proposed a responsibility ethic for the ethical system that tackles the question of "what" system to develop and their use; stakeholder theory determines the concerned group "who" should be considered participants in system development; emancipatory systems development as a methodology of "how" system development can be carried out as an inclusive, socio-politically informed process. The progression lies in presenting structuration theory incorporating the interrelationship of social structures and human agency, which produces "*a socio-political description of the organisational context of ethical system development thereby enhancing the understanding of "why" certain actions are taken*" Dillard and Yuthas (2002:3).

Dillard and Yuthas's (2002) work constitutes a rigorous effort towards presenting a comprehensive conceptual underpinning for the study of ethical considerations in the development and use of expert systems. However, the procedures necessary to test the efficacy and potency of the proposed theory are bound to be highly complex and subjective.

Giddens' conception of structuration has been criticised for being too philosophical and abstract as there appeared to be an absence of clear links to substantive

circumstances and this absence makes structuration theory 'free-floating'. He attempted to capture the general characteristics of entities such as structure, agent, time and space such that these entities would be relevant to all circumstances across times and places. Based on the foregoing criticism, Stones (2005) advocated the 'strong' theory of structuration which bridges Giddens' abstract and philosophical structuration (based on 'ontology in general') to a more substantive level.

Stones suggested for structuration theory a revised and stronger framework which draws from and builds upon the ongoing criticisms, debates, defences and refinements of the theory. This framework he called "'strong' project of structuration" or simply "strong structuration" as it encompasses the key elements of Gidden's original views while it also consolidates and develops these views.

In addition, Stones presented the notion of a quadripartite cycle of structuration to elucidate the variety and nature of the elements involved in the 'duality of structure'. This cycle comprises four separate but inter-linked aspects of the 'duality of structure'. These are: external structures as conditions of action; internal structures within the agent; active agency (operating either routinely and pre-reflectively, or strategically and critically based on his internal structure) and outcomes (as external and internal structures and as events)

Similarly, based on the works of Margaret Archer and Nicos Mouzelis, Parker (2000) advocated the *dualism* of structure and agency which acknowledges both the difference between structure and agency as well as their interdependence as opposed to Giddens' *duality* which recognises an identity between structure and agency. Also, Rose and Jones (2004) criticised Giddens for restricting his application of 'agency' (the capacity to make a difference) to human actors. They believe that technology can also be 'agents' as demonstrated in the actor-network theory. Hence, Rose and Jones (2004) developed a theoretical explanation of the

interaction between human and technology agency useful for the understanding of ICT impact on organisation.

2.4.0: The Emergence of the Research Propositions from the Literature

This section discusses how the research propositions (initially noted on pages 7 and 8) were built upon the existing literature. This is carried out by summarising the studies reviewed earlier with a view to showing their limitations and the overall gaps that currently exist and how this study aims to fill these gaps. Also, the passage of time necessitates a reassessment of earlier studies' conclusions to see if they still hold in spite of the developments in ICT. The following sub-sections discuss the eight propositions in the light of the above:

2.4.1: Proposition I: ICT has had a positive impact on auditing

The use of ICT by auditors in carrying out their tasks of providing an independent opinion on financial statements is thought to enhance auditors' ability to assess the key business processes of their clients, to provide an enhanced focus on business and audit risks and to enable the development of measurable performance indicators for their clients (Bell et al., 1998; Abdolmohammadi and Usoff, 2001; Bierstaker et al., 2001; Helms, 2002). It was in this light that Abdolmohammadi (1987), Bell et al. (1998) and Bierstaker et al. (2001) discussed some of the generic and proprietary ICT tools that have been developed to assist in various aspects of the audit process.

Various benefits have been advocated as accruable from the use of decision aids for audits. These include efficiency and effectiveness (Abdolmohammadi and Usoff, 2001); consistency (Brown and Murphy, 1990); structure for audit tasks (Pieptea and Anderson, 1987); improved decision making and communication (Brown and Murphy, 1990; Wright, 1995); enhanced staff training (Elliott and Kielich, 1985); expertise development for novices (Eining and Dorr, 1991) and shorter decision times (Eining and Dorr, 1991).

However, the following have been identified as possible drawbacks of adopting decision aids: prolonged decision processes as a result of exploring more alternatives (Mackay et al., 1992); the huge cost of building, updating and maintaining systems (Pieptea and Anderson, 1987); the inhibition of novices' knowledge base (Murphy, 1990); the inhibition of professional judgement development (Yuthas and Dillard, 1996) and the risk of the tools being transferred to competitors and the possibility of their being used against the auditor in a court of law for having overrelied on the evidence of decision aids (Abdolmohammadi and Usoff, 2001).

It is noteworthy that none of the studies discussed above on the benefits and drawbacks of using ICT tools and techniques in audit attempted to place their works within the context of a suitable theory.

Furthermore, Abdolmohammadi (1987), Bell et al. (1998) and Bierstaker et al. (2001) mentioned some of the generic and proprietary ICT tools used in audits at the time their studies were undertaken, the exponential growth in ICT tools and techniques suggests the possibility that these tools might have been rendered obsolete by new technological capabilities. As a result, this study intended to assess the current ICT tools that are being used in audits in order to update what is currently detailed in the existing literature. Also, the past studies summarised above indicate that despite the benefits derivable from auditors' use of ICT, such use could still generate some negative consequences. This study therefore seeks to assess what the current effects of ICT on auditing actually are, covering both the positive and the negative effects. In addition, the study aims to assess whether or not the recent developments in ICT have taken care of some of the drawbacks of ICT's use in audits identified in the existing literature. These intentions are covered by the first proposition, 'ICT has had a positive impact on auditing'.

2.4.2: Proposition II: Auditors' use of ICT tools and techniques renders manual techniques obsolete

With regards to auditors' use of ICT in their work, existing literature suggests that there is the possibility that they (auditors) could either over-rely or under-rely on ICT depending on their circumstances. Glover et al. (1996) and Swinney (1999) indicated in their studies that auditors over-rely on expert systems output rather than balancing their professional experience with whatever ICT-based aids suggest when making audit decisions. However, an auditor may be liable for basing his judgement solely on an expert system to make an incorrect judgement just as he/she may be liable for not adequately using a modern decision aid in arriving at a judgement that turns out to be a misstatement (Ashton, 1990; Sutton et al., 1994).

Arnold et al.'s (2004) assessment of the impact of decision aids on expert and novice decision-makers' judgement indicated that only an appropriate combination of user and technology may improve the expert decision-maker's decision quality.

Although the foregoing studies did not explicitly mention the socio-technical systems theory, it is strongly represented in their conclusions by implication.

It can be observed that the sequence of the above studies appears logical. It started from little reliance on ICT-based decision aids in the early 1990s (due to fear of litigation) to excessive reliance in the late 1990s with Arnold et al.'s (2004) conclusion moderating the two extreme positions. As a result of the fact that Arnold et al. (2004) have been able to publish their work before this study (which actually started in 2002) is concluded, this study can be said, to a reasonable extent, to assess the works of Arnold et al. (2004) in a more general context (ICT tools and techniques rather than just decision aids) as it examines the extent to which technology is being adopted in audit practices compared to manual techniques. This is probed in the second proposition, 'Auditors' use of ICT tools and techniques renders manual techniques obsolete'.

2.4.3: Proposition III: The extent of ICT utilisation for audit assignments is affected by audit firms' and clients' size, the nature of audit tasks and auditors' experience

Xiao et al. (1996) were able to propose the use of the contingency theory of organisation as a useful framework through which to evaluate and predict the impact of ICT on CFR. This perspective was initially touched upon in the work of Wilson and Sangster (1992) who stated that ICT could have a positive impact on audit efficiency and effectiveness depending on contingent factors such as task domain characteristics and skill availability among others. Also, Manson et al.'s (1997) study posited that medium sized and large audit firms use ICT more than their small counterparts in the planning, controlling and recording of audit tasks because of the size of the former's usual clients as well as ICT's capital intensiveness.

It is clear from the studies above that only Xiao et al. (1996) directly discussed the applicability of the contingency theory to CFR, a much wider concept compared to just auditing. However, the study was hypothetical and devoid of empirical evidence. The other two studies neither applied nor acknowledged the relevance of contingency theory in their works even though part of their conclusions alluded to it. This study, however, combined the various contingent factors identified by Xiao et al. (1996) and those reflected in the results of Wilson and Sangster (1992) and Manson et al. (1997) in order to ascertain the relevance of the theory for the study of ICT's impact on auditing and to advance the frontiers of knowledge in this area. This is achieved through the third proposition, 'the extent of ICT utilisation for audit assignments is affected by audit firms' and clients' size, the nature of audit tasks and auditors' experience'.

2.4.4: Proposition IV: ICT does have potential ways of impacting on auditing

Bierstaker et al. (2001) put forward the idea that ICT's positive impact on the audit process was expected to continue for the foreseeable future. Although one might

tend to agree with this view due to the exponential growth of ICT's utilisation in modern business, another line of thought might suggest that, perchance, ICT's growth has reached its peak and its utilisation in audit is bound to remain the same in future. As Bierstaker et al. (2001) happened to be the only study in the literature that predicted the future relevance and continuous impact of ICT on audit, this study aims to examine whether this prediction earlier in this decade is currently being fulfilled and capable of being fulfilled in the future and, if it is, under what circumstances? Hence, the fourth proposition was drawn to see, from the auditor's perspective, if 'ICT does have potential ways of impacting on auditing'.

2.4.5: Proposition V: Audit automation affects the structure of an organisation

Using both Giddens' structuration theory and Coombs et al.'s (1992) study, Manson et al. (2001) explored both the individual and structural relationships involved in the use of ICT by audit firms and drew the conclusion that ICT could have specific implications for the behaviour and attitudes of individuals working in audit firms and it could affect the structure and processes of the firm as well as its competitive and human resource strategies. Similarly, Caglio (2003) used the structuration theory in his study and advocated a form of 'hybridisation' between the roles of the accountant and those of IS and line operators. He also conceptualised the potential change in accountants' practices and position as a structuration process.

Bagnall (1991) put forward the idea that ICT might have an indirect human resource implication for audit firms as it might be responsible for the then reduction in both clerical and professional staff in the firms. Manson et al. (1997) argued that although the use of ICT might not contribute to deskilling professional auditors, secretarial and clerical staff in audit firms were losing out as auditors were taking over most of their roles due to the latter's increased automation of their works.

It is worthy of note that Bagnall's (1991) study was undertaken in a period of economic recession with a hallmark of general redundancies which affected both the professional and non-professional workforce, whereas Manson et al.'s (1997) was conducted in a time of economic boom when ICT's use in audit had increased. This suggests that Bagnall's (1991) results might not be entirely ascribable to the impact of ICT's adoption.

This study however seeks to examine which of the two conclusions above is currently tenable given the current level of ICT's sophistication and use in audit. The study also seeks to determine whether or not the view that ICT could affect audit, auditors and audit organisations' structures still holds by assessing the effects of audit automation on the structure of audit tasks, audit firms/departments and the audit profession based on current realities in today's world of technology. The fifth proposition which states that 'audit automation affects the structure of an organisation' is used for these purposes.

2.4.6: Proposition VI: COA could be considered the future of auditing

Searcy and Woodroof (2003) suggested that COA would be able to take care of the wastages commonly associated with the traditional audit process. These include overauditing, delay in data accessibility, time delay, cumbersome process, errors and mistakes. Higson (2002) predicted that COA would possibly be the fifth generation of audit following Davis's (1996) description of four audit generations.

Kogan et al. (1999) identified the factors, institutions and technologies responsible for COA's development and the risks involved in its use and concluded that widespread availability of computer networking makes it possible to dramatically increase the frequency of periodic audits by redesigning the auditing architecture around online auditing.

Rezaee et al. (2001) predicted that the rapid growth in technological advancement (especially as it relates to Extensible Business Reporting Language (XBRL) being gradually built into accounting software) might make online real-time preparation, publication, examination and extraction of financial information more widespread in the business world while Lymer and Debreceny (2001) mapped the growth of online corporate reporting through earlier propositions and arguments presented by academics and other concerned groups.

In the US, the Institute of Internal Auditors (IIA) Research Foundation's (2003) study indicated that internal auditors showed interest in continuous auditing even though they believed they lacked training, funds and skills to apply this concept.

All the studies discussed above attempted to discuss the usefulness of COA and its likely future directions. In addition most of them were not empirical in nature and they are all based on an American techno-economical context. As a result of these observations, this study attempts to assess, through empirical data, COA's relevance and its likely future use from both the external and internal audit perspectives within the UK's techno-economic context. This is carried out through the sixth proposition, 'COA could be considered the future of auditing'.

2.4.7: Proposition VII: Audit automation impacts on auditor independence

The concept of auditor independence is a crucial aspect of the audit profession. Although Alles et al. (2002) posited that auditor independence might be affected as clients' systems progressively become more and more integrated with auditors' and auditors play advisory roles to their clients on the design of and changes to internal controls, their study was a mere theoretical suggestion based on their observations on the technology and workings of COA. In addition, to date, none of the existing literature has further examined this area of research suggested by Alles et al. (2002). This study therefore examines current views of the effect COA as well as other ICT-based techniques used in audit could have on auditor

independence thereby making an original contribution to knowledge. This intention is achieved through the seventh proposition which states that 'audit automation impacts on auditor independence'. The areas earmarked for the investigation of this proposition include auditors' reliance on their clients' IS for their work, their involvement in the AIS' computerisation of clients and how automation could affect their professional competence, expertise and opinions.

2.4.8: Proposition VIII: Audit automation impacts on the Audit Expectations-Performance Gap

Omoteso et al.'s (2003) evaluation of how ICT can be helpful in recognising and possibly overcoming auditors' methodological limitations (such as sampling), communications deficiency (through COA and the Internet) and the performance deficiency (through the use of DSS and KBES) remains the only effort on the subject. The study was based on Porter et al.'s (1993) discussion of the components of the AEG and indicated that ICT can play an important role by providing a communications infrastructure to enable wider consultation, faster dissemination, information repositories and faster, more flexible information search and retrieval facilities. However, the study was deductive rather than empirical. As such, this study intends to examine the same phenomenon with the aid of collected data to see if the same conclusions will be reached. Also, the validity of the conclusions reached on this aspect of the study will be enhanced as they are backed up by primary data and such conclusions will contribute to the on-going debate on the AEG in a unique way, the angle of ICT.

2.5.0: Conclusion

This chapter has provided a modest review of the existing literature relevant to this research in the areas of audit automation, computer-assisted auditing tools and techniques, decision support systems, neural networks, knowledge-based expert systems and continuous online auditing. It has done this by discussing each of the selected studies in terms of a brief description of its results as well as an analysis

and a critique of its content and adopted theoretical and methodological underpinnings. The chapter also expounded the three theoretical frameworks used in this study and provided an explanation of how the eight research propositions were derived from the literature.

The chapter primarily presented relevant research efforts so far in order to assess and identify the gaps that currently exist, some of which this study intends to fill using the reviewed theoretical underpinnings (through the stated propositions) in order to move forward the frontiers of knowledge in the subject area. In addition, it could be observed from the review that most of the literature reviewed was published in the last century and as developments in ICT continue to spread their tentacles through the 21st century business world, a periodic re-assessment of the current and potential impact of ICT will be necessary on an on-going basis.

The study also recognises, however, that there are considerable lead times involved in identifying, designing, implementing and standardising appropriate technologies. Also, turbulence in business environments due to globalisation and rapid technological growth further compounds the problems. Therefore, the purpose of the study is to take stock of the situation rather than to provide a comprehensive solution and based on the experience to conceptualise, if possible, a framework that facilitates the periodic re-assessment of the impact of ICT on the audit profession.

Having reviewed the relevant literature and given an overview of the intended theoretical frameworks for this study, the following chapter will focus on the methodological approach that is thought to be most suitable for the research.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0: Introduction

The last two chapters mapped the views, opinions and arguments of a wide range of authors contained in existing journals and texts on audit automation, the use of decision aids in audit, CAATT's and COA as underpinned by certain theoretical and methodological foundations. This was carried out in order to review the existing literature and place this study within this context in terms of its intended contribution to the knowledge and auditing practice and the practice of auditing.

This chapter explains the methods and procedures involved in collecting and analysing useful data necessary to make the contributions as stated above. The rest of the chapter is arranged into sections focussing on the philosophical basis of the study's methodology, research instruments (design and piloting), data collection, data analysis and limitations of the methodology.

3.1.0: Philosophical Basis of the Methodology

The two dominant paradigms recognised as forming the philosophical foundation of modern research are positivism (otherwise referred to as quantitative, scientific or objectivism) and phenomenology (otherwise called qualitative, interpretivism or social constructionism). The former implies that the researcher is working on an observable social reality and such an endeavour can generate laws or law-like generalisations similar to those obtainable in the physical and natural sciences, whereas the latter focuses on the primacy of subjective consciousness and propagates the study of direct experience in which behaviour is perceived to be determined by the phenomena of experience rather than by external, objective and physically described reality (Remenyi et al., 1998).

Although Filstead (1979) put forward the idea that the distinction between the two paradigms goes beyond the research strategies and data collection procedures adopted as they represent fundamentally different epistemological frameworks for conceptualising the nature of knowing social reality and the procedures for comprehending these phenomena, research undertakings in recent years indicate that the distinction between the two paradigms is now being reduced to mere technical matters depending on their suitability in answering particular research questions. Consequently, it is no longer surprising to see a particular researcher who claims to be a positivist using techniques or assumed characteristics peculiar to phenomenology and vice versa (Remenyi et al., 1998).

The philosophical underpinning of this study is a combination of the two paradigms, positivism and phenomenology, as it shares characteristics of both schools of thought. These include observer independence, seeking how, why and how much, relevance of human interests (phenomenology), increased general understanding of the situation, theoretical abstraction and a fairly large sample size (positivist) among others. Saunders et al. (2003) described this as a sort of mid-point between the two main research paradigms. The study could be described as belonging to the philosophy of relativism (or critical realism) as it aims to look into the peculiarities of the study (ICT impact on planning, controlling and recording of audit processes across different industries) in relation to the nature, orientation, politics and culture of the organisations to be involved in data collection.

The combination of these two research methodologies, qualitative and quantitative, is generally referred to as triangulation. The term triangulation has its root in surveying *"in which a region is divided into a series of triangles based on a line of known length so that accurate measurements of distances and directions may be made by the application of trigonometry"* (Remenyi et al., 1998:142). Easterby-Smith et al. (2002) classified triangulation in research into three: Data triangulation (using different frames to collect data), methodological triangulation (combining

both qualitative and quantitative methodologies) and theoretical triangulation (borrowing models from another discipline). This study meets these three classifications of triangulation described by Easterby-Smith et al. (2002) as it adopted both the interview and questionnaire survey methods to collect data (data triangulation) using suitable qualitative and quantitative data analysis techniques (methodological triangulation) to examine the applicability of some theoretical models borrowed from the fields of management (contingency theory) and sociology (structuration and socio-technical theories) to the study of ICT's impact on auditing (theoretical triangulation).

The triangulation approach will be useful in a situation where the researcher anticipates a low response rate (Bryman and Bell (2003). Therefore, as the nature of this study involved auditors who are normally very busy professionals, it was decided that a combination of both research approaches (qualitative and quantitative) was the most appropriate as the chance of collecting a larger volume of data might be higher because participating organisations and individuals are able to select either of the two options (interview sessions or questionnaire completion) as they deemed suitable. Also, the triangulation approach is more fitting for this study as it allows the researcher to crosscheck the findings obtained through the interview with the ones obtained through the questionnaires for enhanced validity and generalisability. Combining the two approaches of data collection also provides an implied back-up system for the study in case the data obtained through one of the methods was insufficient, became corrupted or lost.

The mixed method of questionnaire and one-to-one in-depth interview makes the study more robust due to a variety of factors. These include the higher number of participants, the observer's independence, the quality of the data obtained, the ability to evaluate facts quantitatively and qualitatively and respondents' independence (Palmerino, 1999; Easterby-Smith et al., 2002).

In addition, the advantage of a triangulation method lies in the comprehensiveness of its analysis which in turn enhances the quality of the results and their attendant wider acceptability and replicability. Further, the method would enhance a better undertanding of the phenomenon being studied, that is, the current and potential ICT impact on auditing. Easterby-Smith et al. (2002) argued that the mixed method of data collection prevents the research from being method-bound as the method combines the strengths of both approaches (qualitative and quantitative) as well as off-setting the deficiencies of one approach with the other's strengths.

Also, the mixed method would be appropriate because most of the past research on the impact of ICT on business have either used a quantitative or qualitative approach. The choice between the two approaches really depended on the background, proficiency and epistemological inclination of the author(s) in question. Of the thirty-three shortlisted relevant studies, nine used qualitative methods in the form of either interviews, case studies, observation or action research (Orlikowski, 1992; Coombs et al., 1992; Remenyi, 1992 ; Bonner et al., 1996; Fischer, 1996; Bierstaker et al, 2001; Manson et al, 2001; Caglio, 2003; Institute of Chartered Accountants in England and Wales, 2003), twenty-two adopted the quantitative approach in the form of either experiment or questionnaires (Abdolmohammadi, 1991; Wilson and Sangster, 1992; Eining and Dorr, 1991; Bamber et al., 1996; Eining et al., 1997; Anderson et al., 1997; Green and Choi, 1997; Swinney, 1999; Greenstein and Hamilton, 1997; Manson et al., 1998; Bell et al., 1998; Lenard et al., 1995; 2001; Lowe and Reckers, 2000; Abdolmohammadi and Usoff, 2001; Hodge, 2001; Boritz and Hunton, 2001; Wilks 2002; Lowe et al., 2002; Bedard and Graham, 2002; Arnold et al., 2004; Messier et al., 2004) while Manson et al. (1997) and Banker et al. (2002) used a triangulation of qualitative and quantitative techniques. However, the most comprehensive of all remains the work of Manson et al. (1997) funded by the Institute of Chartered Accountants of Scotland where a triangulation of methodology was adopted and

this served as a basis for more than four other research works (in the form of academic papers) by the authors.

The study falls into one of the three forms of Easterby-Smith et al.'s (2002) theoretical developments that may emanate from a pure research, reflection, as it re-examines in different organisational contexts the relevance of contingency, structuration and socio-technical system theories in the study of ICT's impact on auditing and the audit process. The results of the research are also able to provide auditors with new areas in which ICT might be of immense value and benefit to their profession, thereby fitting into the domain of applied research.

Although questionnaires were administered and quantitatively analysed, this was combined with the qualitative approach (through the conduct of interview) as the study focuses on human-computer interrelationships and as such triangulation was suitable for the investigation of the complex implications of ICT on auditing and auditors themselves as well as the organisations they work for. Besides, the qualitative method provided adequate perspectives on the phenomena being studied.

However, care was taken in using a triangulation method because it sometimes leads to contradictions and confusion and this may make the reality of the phenomenon being investigated become too complex (Easterby-Smith et al., 2002). Also, just as the method can combine the advantages of both the qualitative and quantitative methods, the tendency is high that it may prove too cumbersome with the combination of the shortcomings of both approaches. These include a time consuming data analysis, opposing responses from both approaches and cost implications among others. In order to avoid these potential weaknesses of the approach, the number of interviews conducted as well as the questionnaires used in the study were kept within a reasonable limit.

The study is a cross-sectional study because it focused on a particular phenomenon within a limited time frame and it employs the use of survey (Remenyi et al., 1998; Easterby-Smith et al., 2002) as the time frame and resources available could not support a longitudinal study which could have been more detailed and comprehensive which spreads across a fairly long period. Using a cross-sectional approach allows the researcher to carry out the study in its natural, real life settings thereby enhancing the validity of the research. Similarly, the research is exploratory as it attempts to seek new insights into what is happening around audit automation, covers a literature search and conducts interviews with experts in the field (Saunders et al., 2003).

Above all the study is exploratory in nature as it investigates the current impact and future directions of ICT use in audit and as stated earlier it aims to take stock of the situation rather than to provide a comprehensive solution. In addition, one of its main objectives is to assess the most fitting theoretical model for assessing ICT impact on auditing.

3.2.0: Research Propositions

The research objectives outlined in the first chapter were scrutinised through the gaps obtained from the review of literature in the last chapter to arrive at eight research propositions central to the main contributions of this study. These propositions are grouped into two sections as shown below

3.2.1: Section A: Current Implications of ICT for Auditing

i. ICT has had a positive impact on auditing
ii. Auditors' use of ICT tools and techniques renders manual techniques obsolete
iii. The extent of ICT utilisation for audit assignments is affected by audit firms' and clients' size, nature of audit tasks and auditors' experience

3.2.2: Section B: Future Directions of ICT Impact on Auditing

iv. ICT does have potential ways of impacting on auditing
v. Audit automation affects the structure of an organisation
vi. COA could be considered the future of auditing
vii. Audit automation impacts on auditor independence
viii. Audit automation impacts on the Audit Expectations-Performance Gap

These propositions were further broken down into simple research questions as contained in different sections of the questionnaire and the interview questions (see appendices B and C).

3.3.0: Research Instruments

Primary data were collected by means of questionnaire and interview. A questionnaire survey is a positivistic technique whereby a sample size is drawn from a population and analysed to arrive at certain conclusions about the entire population (Hussey and Hussey, 1997). Sampling was necessary as it was not possible due to lack of time and other resources to survey or interview the entire population of auditors in the UK.

This research adopted a non-probabilistic sampling technique because of the nature of the study. As audit remains a specialised discipline in the accountancy profession, therefore, a study that is aimed at investigating the impact of ICT on auditing cannot be based on a random sampling either across industries or within a particular chosen organisation, as it requires peculiar target research subjects.

3.4.0: The Research Design

3.4.1: The Questionnaire and the Interview Questions

The process of the questionnaire design stemmed from the eight research propositions outlined above. Each proposition was thus translated into specific relevant questions as answers to these questions were expected to provide the necessary data for evaluating the proposition (Frankfurt-Nachmias and Nachmias, 1996). The questionnaire comprised six sections. The first section contained ten questions relating to respondents' personal details such as qualifications, age bracket, work experience and gender among others. The second section contained thirty-three questions that centre on the relationship between respondents' jobs and ICT. The third section focused on the possible link between respondents' organisations and ICT with thirty-nine questions. The fourth section consisted of eleven questions to assess the usefulness, extent of use and potential of COA while the fifth and sixth sections contained ten and nine questions respectively to assess the impact of ICT on auditor independence and the AEG.

The whole of the first section of the questionnaire was focused on respondents' details necessary for analysing their profiles. These were 10 questions altogether covering questions A1 to A10. Some of these questions were also used for crosstabulation and correlations to test for association between respondents' profiles and the pattern of their responses.

The remaining 102 questions contained in the other five sections and the entire 14 interview questions were designed to probe into the eight propositions as shown in the table below:

Propositions	Questions' Number as shown in the questionnaire	Questions' number as shown in the interview questions
<u>Proposition I</u> **ICT has had a positive impact on auditing.** *The questions relevant to this proposition are categorised below into three themes exploring the current state of affairs and the fourth assessing the usefulness of ICT to audit.		
*Auditors' current level of use of ICT tools and techniques	B1 to B4 B13 to B15 B17 to B19 B26 to B27 C10 to C18 B16	5 - 6
*Organisations' current level of provision of ICT tools and techniques for audit purposes	C1 to C7 C20 C33 C37 to C38	
*Current Benefits and Drawbacks of ICT Use in Audits	B32 C39 B17	
*The usefulness of ICT to audit steps, tasks, efficiency and effectiveness	B5 to B12 B28 to B29 B31 to B32 C24 to C27 C30 to C32 C34	1

Propositions	Questions' Number as shown in the questionnaire	Questions' number as shown in the interview questions
<u>Proposition II</u> **Auditors' use of ICT tools and techniques renders manual techniques obsolete.** * These questions are to assess the auditors' level of ICT use compared to manual techniques in order to determine whether one technique is preferred to the other	B26 B30	3 to 5
<u>Proposition III</u> **The extent of ICT utilisation for audit assignments is affected by audit firms' and clients' size, nature of audit tasks and auditors' experience.** * These questions were aimed at assessing the suitability of the factors above as contingent factors necessary for the use of ICT in audit	B20 to B25 C28 to C29	7 to 9
<u>Proposition IV</u> **ICT does have potential ways of impacting on auditing** *These questions are directed at examining the likely areas of audit that may require further utilisation and developments of ICT tools and techniques	B33	2
<u>Proposition V</u> **Audit automation affects the structure of an organisation.** * These questions relate to various aspects of structuration. They include structures of the organisation, tasks and roles; the recruitment, promotion and number of auditors at different levels	C8 to C9 C19 C21 to C23 C33 C35 to C36 C39	6

Propositions	Questions' Number as shown in the questionnaire	Questions' number as shown in the interview questions
<u>Proposition VI</u> **COA could be considered the future of auditing.** * These questions are intended to determine how useful COA is perceived to be in dealing with fraud in terms of prevention, detection and investigation. Also, COA's relevance in protecting the interests of all the stakeholders in a business is examined through some of the questions.	D1 to D11	10 to 12
<u>Proposition VII</u> **Audit automation Impacts on auditor Independence** * The questions are based on the various aspects of auditor independence identified in the literature to assess how ICT could impact on these areas of auditor independence	E1 to E10	13
<u>Proposition VIII</u> **Audit automation Impacts on the Audit Expectations-Performance Gap (AEG)** * The questions are based on the dimensions of AEG discussed in the literature to determine the effect of ICT on the identified dimensions of AEG	F1 to F9	14

Table 3.1: Relevance of the Questions Used in the Questionnaire and the Interview to the Study

In designing the questionnaire, particular attention was paid to the type, format and general layout of the questionnaire to ensure it suited the method of data collection, the self-administered questionnaire. The questions were written in short simple language and care was taken to avoid leading, threatening and double-barrelled questions. Ambiguous, complex and lengthy questions were also

avoided. Above all, the validity (in terms of content, construct and criterion-related) as well as the reliability of the instrument was taken into consideration (Denscombe, 1998).

The questionnaire was a mixture of both open-ended and fixed alternative questions. The open-ended questions were designed to give respondents the opportunity to supply their responses as they thought suitable (without being given any list of possible responses to select from) while the fixed alternative questions used mainly a five-option Likert scale.

3.4.2: The Pilot Study

A pilot study involves pre-testing the measuring instrument in order to detect possible deficiencies in its design and administration and to clarify any areas in which further information is needed with which to complete the answers to the questions asked (Emory and Cooper, 1991). It involves testing the questionnaire on a set of people that are not too divergent from the target respondents in terms of, for example, age, gender, educational and ethnic characteristics (de Vaus, 1996; Zikmund, 2003). This could be carried out formally through a small sample of the target subjects or informally through friends, colleagues and experts among others (Remenyi et al, 1998).

The questionnaire was designed and piloted prior to the main study. The reason for this was to test the validity and reliability of the instrument with regard to its ability to achieve its purpose of collecting useful and quality research data targeted at the main areas under investigation. The pilot questionnaire included a covering letter addressed to each respondent regarding the main objectives of the study and assuring them of their anonymity and of the confidentiality of the data they would supply in the questionnaire. This introductory letter was followed by a guideline on how to complete the questionnaire. The questionnaire was organised as follows:

Section	Title	Number of Questions		
		Scaled Items	Open Ended Questions	Total
A	About Me	6	4	10
B	My Job and ICT	29	6	35
C	My Organisation and ICT	44	-	44
D	Continuous Online Auditing	13	2	15
E	ICT and Auditor Independence	11	2	13
F	ICT and the Audit Expectations-Performance Gap	14	2	16
Total		117	16	133

Table 3.2: Structure of the Pilot Questionnaire

A two-line space was provided after each question for respondents' comments. This made it possible for respondents to explain their responses with further details and to enable them to query the clarity or simplicity of any question.

The pilot study commenced in mid-January 2004 and spanned the whole of February 2004. Access was sought to some of the organisations through personal contacts while others were identified through the Internet and approached for help with the piloting. In all, four organisations participated in the exercise while some experienced academics were contacted for their views on the quality of the questionnaire and its ability to achieve the stated research objectives. The breakdown of the respondents to the pilot study is as shown in the following table:

Organisation	Type of Business	Number of Questionnaires Returned
A	A "big4" Audit Firm	4
B	A Medium-Sized Audit Firm	1
C	A "big7" UK Bank	5
D	A City Council	2
E	Academic	4
Total		16

Table 3.3: Analysis of the Returned Questionnaire by Business Sector

The observations made from the pilot study are as summarised below.

Some respondents were of the view that the questionnaire was too long (thirty-four pages) and as such difficult and time consuming to complete. In response to this, the scaled questions were tabulated and the number of responses required for the open-ended questions was reduced. In addition, some respondents suggested the covering letter be modified to leave out some details that were not needed by respondents and some questions that were positively and negatively worded be merged into single questions. These observations were incorporated accordingly. An example of such questions is as follows:

i "COA could make auditors more independent"

5	4	3	2	1
Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
☐	☐	☐	☐	☐

ii. "COA could make auditors less independent"

5	4	3	2	1
Strongly Agree	Agree	Neither Agree Nor Disagree	Disagree	Strongly Disagree
☐	☐	☐	☐	☐

The above two questions were accordingly combined into a single question as:

"COA could make auditors..... of/on their clients"

5	4	3	2	1
Greatly Independent	Independent	Neither Dependent Nor Independent	Dependent	Greatly Dependent
☐	☐	☐	☐	☐

Furthermore, some respondents suggested that the open-ended questions should request responses to be in order of priority as this might have some implications for the data analysis. An appropriate clause was therefore inserted into the questions concerned. Also, it was clear from the responses obtained that four of the questions contained clauses that were capable of being misinterpreted and these were amended accordingly.

Some pilot respondents thought that some of the key terms could be ambiguous to the respondents. Examples of these terms are Information and Communications Technology, Continuous Online Auditing and Audit Expectations-Performance Gap used in the questionnaire. As a result, a brief explanation of these key terms was included in the appropriate sections of the revised questionnaire before asking questions on these topics so as to obtain useful responses suitably focused on the issues concerned.

The final questionnaire was thus produced in just thirteen (13) pages as against the original thirty-four (34) pages. The following table shows the breakdown of the final contents of the questionnaire:

Section	Title	No of Questions		
		Scaled Items	Open-Ended Questions	Total
A	About Me	6	4	10
B	My Job and ICT	27	6	33
C	My Organisation and ICT	39	-	39
D	Continuous Online Auditing	9	2	11
E	ICT and Auditor Independence	8	2	10
F	ICT and the Audit Expectations-Performance Gap	7	2	9
Total		96	16	112

Fig. 3.4: Structure of the Final Questionnaire

The interview questions were piloted with three auditors and two academics within Leicester to test their effectiveness in terms of their ability to generate adequate responses for the analysis of the eight propositions earlier identified. The piloted interview questions were upheld as the final interview questions for the study as they were found to generate responses useful for the studies.

3.5.0: Data Collection

As the study involved the activities of both internal as well as external auditors, a list of accounting firms, corporate establishments and government authorities of varying sizes was compiled through the use of various directories and the Internet. A letter was collected from the appropriate authority within the university confirming the authenticity of the researcher's identity and intent to would-be participants in the study (see appendix B). In addition, the researcher wrote letters explaining the purpose of the research and requesting participation were sent out in the first week of March 2004 to the partners in charge of audits and assurance services / heads of internal audit departments in 96 organisations (see table 3.5 below). The organisations were requested to confirm their willingness to participate in the study by completing questionnaires and granting interviews.

	Organisation's Description	Number of Organisations
1	"big4" Accounting Firms	4
2	Other Accounting Firms	46
3	Public Sector Organisations	26
4	Corporate Organisations	20
Total		96

Table 3.5: Analysis of Organisations Contacted for the Study

In the first instance, only 14 of the organisations contacted actually responded. 12 agreed to complete questionnaires while two agreed to interviews. As a result of this low response, follow up letters, e-mails and telephone calls were made to the organisations that were yet to respond and this finally resulted in the participation of thirty-six (36) organisations in the study which indicates a 37.9% response rate. The following tables show the breakdown of the organisations that eventually participated in the study according to the nature of their areas of operation:

3.6.0: Analysis of Participating Organisations

	Organisation's Description	Number of Organisations that Participated In:		TOTAL
		Questionnaire	Interview	
1	"Big4" Accounting Firms	4	2	6
2	Other Accounting Firms	12	0	12
3	Public Sector Organisations	9	1	10
4	Corporate Organisations	6	2	8
TOTAL		31	5	36

Table 3.6: Analysis of Participating Organisations

NOTES:

1. *Two of the "big4" accounting firms rejected the idea of distributing questionnaires to their staff or interviewing them. They claimed this would be possible only if the research were funded by one of the accountancy institutes. As a result, the only compromise to be reached was to accept a single response from each of these two firms as representative of their firms' views.*

2. *One of these two "big4" firms gave an institutional response for the interview. This response was accepted and analysed accordingly as the study will certainly be enhanced by any form of response from any "big4" firm as they use ICT most in their audits as this study later indicates.*
3. *Participation in interviews and questionnaires were mutually exclusive as none of the 36 organisations participated in both.*
4. *The questionnaire was accompanied by an introductory letter from the researcher explaining the purpose of the study and assuring subjects of anonymity and confidentiality as contained in the ethical regulations governing the conduct of research concerning human subjects (see appendix A).*

Each organisation designated an officer as its contact person and through these officers, questionnaires were distributed to the auditors working in the participating establishments. Similarly, the designated officers arranged the interview schedules within their organisations.

Most of the contact officers preferred an electronically compatible questionnaire so that it might be easier to forward to would be respondents to be completed and sent back to the researcher. Consequently, more than forty percent of the questionnaires received were in soft form. As a result of the above procedures, while it would be quite easy to determine the number of questionnaires returned, the same cannot be said of the number actually distributed.

The interview was semi-structured and conducted at respondents' convenience considering the busy schedules of the auditors involved. This was based on a list of questions prepared and pre-tested by the researcher. The questions were tailored to suit the rank and responsibility of each interviewee and sent to them at least 1-2 weeks prior to the date fixed for the interview. Each interview session was conducted on a one-to-one basis and in private to guarantee confidentiality. The subjects were equally assured that data gathered from them would not be disclosed to their employers and each interview session was tape-recorded with the permission of the interviewee and later transcribed to avoid loss of vital data.

This was complemented by the researcher's notes taken during the interviews. These notes were to serve as a back up in case the technology of tape recording broke down or the cassette could not be accessed.

In all, between two and seven people (at different levels) were interviewed in each participating organisation. All interviews were carried out in strict and logical order so as not to miss any stages out and each session lasted a maximum of forty minutes except some few circumstances when the interviewee did not have much to say.

The study was initially intended to cover the activities of just five business organisations viz.: two of the big four audit firms (comprising Deloitte and Touche, Ernst and Young, KPMG and PricewaterhouseCoopers) and one company each from the service, manufacturing and public sectors of the economy. The original idea behind this limited sampling was to enable the study to cover all the important sectors of the UK's economy. While the two "big4" audit firms would have adequately represented the audit firms involved in external audits, the other three organisations would have represented the views of complex internal audit systems for public and private commercial establishments.

However, a careful analysis of the sample size showed that one of the theoretical bases of the study, the contingency theory, would be invalidated as the size of the organisations to use would need to be varied. This necessitated an adjustment to the target organisation to include business organisations of different sizes (small, medium and large). The yardstick for determining the size of an organisation is stated below:

Criteria/Size	Small	Medium
Employees	50	250
Gross Asset Value	£2.8m	£11.2m
Turnover	£5.6m	£22.8m

Table 3.7: Yardstick for Determining the Size of an Organisation: Actual figures not exceeding the limits above.

According to the Companies Act 1985 (as amended), any company that meets at least two of the above stated criteria could be classified as a small (or medium) company provided such a company is not a public company, a banking or insurance company or an authorised person under the Financial Services Act (1986) .

The details required for determining the size of the participating organisations were obtained from their annual reports and accounts. However, it is worthy of note that the criteria above are not applicable to audit firms as they are not required by statute to publish their accounts. Therefore, the size of these firms was determined on the basis of the number of partners (1-10 partners: small; more than 10 partners: Medium; "big4": Large).

In addition, the researcher's inability to gain access into the original selected organisations suggested that the initial plan had to be modified in order to reach sufficient large organisations. This effort resulted in the following level of individual respondents' participation:

	Questionnaire		Interview	
	Frequency	Percent	Frequency	Percent
"Big4"	24	32.4	7	41.2
Other Accounting Firms	19	25.7	0	0.0
Public Sector Organisations	21	28.4	5	29.4
Corporate Organisations	10	13.5	5	29.4
Total	74	100.0	17	100.0

Table 3.8: Category of Organisation

The questionnaire distribution and collection exercise which started in March 2004 was closed at the end of August 2004 while the interview process had ended two months earlier.

3.7.0: Data Analysis

The first task after the data collection was to sort, edit and code the data collected. The data gathered through the tape-recorded semi-structured interview were analysed based on the strength of the views, explanations and arguments obtained from interviewees. This encompassed the evaluation of the nature and origin of viewpoints as well as their reasons and consequences taking adequate cognisance of interviewees' choice of words, body language, facial expression and tone among others (Remenyi et al., 1998: 96). In addition, the data obtained through the relevant sections of the administered questionnaires were analysed through the use of the Statistical Package for the Social Sciences (SPSS) to generate both univariate and bivariate analyses in the forms of frequency tables and crosstabulations respectively. The latter is further strengthened by the use of spearman's rank correlation, a non-parametric technique used for measuring linear association between two variables based on ordinal datasets (Hussey and Hussey, 1997: 230). Spearman's rank correlation technique has been chosen because it is the most suitable for the structure of the questionnaire, which generated ordinal datasets.

The frequency tables provide a set of figures for the 'what' aspect of a research question while the crosstabulations and correlation coefficients provide possible reasons for the outcomes generated by the frequency tables, thereby answering the 'why' question (de Vaus, 1996). These three descriptive statistical methods are the main techniques adopted for reaching conclusions on the basis of responses to the scaled questions.

Each frequency table is used for the analysis of responses to each key scaled question and for working out the Weighted Average Score (WAS) for each table in order to draw a conclusion. The Likert scales have been assigned a score of 1, 2, 3, 4 and 5 respectively for options ranging from, for example, Strongly Disagree (1) to Strongly Agree (5). The frequency of responses on each scale was multiplied by the weighting factor (e.g. 10 x 1 + 20 x 2 + 25 x 3 + 15 x 4 + 12 x 5 = 245) divided by the total frequency of responses for the question (i.e. 10 + 20 + 25 + 15 + 12 = 82) giving a WAS of 245/82 = 2.99 which indicates a mid-position with no particularly strong opinion on the question (i.e. either a very polarised view between agreement and disagreement or a view that leans more towards Neither Agree Nor Disagree). The further towards either end of the scale the result of the above calculation, the greater the overall strength of opinion among the respondents, which is a useful indicator for analysis. The WAS and the percentage frequency for every question in the questionnaire as used in the following two chapters are presented in Appendix E.

According to de Vaus (1996: 155), "*crosstabulations are a way of displaying data so that we can fairly readily detect association between two variables*". A crosstabulation, as similar to correlation, allows us to view the frequencies of two categories of variables and the relationships or association between the pairs of variables being combined. However, these techniques do not show the direction of causation as regression analysis would do by identifying the independent and dependent variables.

In spite of the above limitation, crosstabulations and correlations have been very useful and effective techniques for the analysis of this study's data. This is because they provide much more detail than the comparison of means in terms of the components of the variables being considered and the ability to interpret the figures at a glance, the crosstabulation is simple to use and understand as the details required can be read directly from the table and, more importantly, it

provides a moderate depth of quantitative analysis given the triangulation methodology this study adopts. The open-ended parts of the questionnaire were analysed with the use of Microsoft Excel and Access.

Furthermore, some of the key questions are further analysed on the basis of either each responding auditor's type (internal or external), age, gender and experience or class of audit, category of organisation and type of business depending on whether the questions relate to auditors themselves or the organisation they work for. This is in order to determine whether these selected variables form the bases for variations in the responses obtained.

To determine whether or not there is a relationship between two variables based on crosstabulation analysis, the following criteria are used:

- If the difference between the two variables is less than 25%, no relationship exists
- If the difference between the two variables is between 25% and 49%, there is a weak relationship
- If the difference between the two variables is 50% or more, there is a strong relationship.

Similarly, in reaching conclusions on the correlation coefficients generated through the SPSS, the following criteria were used:

- 0.85 to 0.99: A very high degree of positive correlation
- 0.65 to 0.84: A high degree of positive correlation
- 0.35 to 0.64: A moderate degree of positive correlation
- 0.15 to 0.34: A low degree of positive correlation
- 0.01 to 0.14: No or negligible positive correlation
- - 0.01 to - 0.14: No or negligible negative correlation

- - 0.15 to - 0.34: A low degree of negative correlation
- - 0.35 to - 0.64: A moderate degree of negative correlation
- - 0.65 to - 0.84: A high degree of negative correlation
- - 0.85 to - 0.99: A very high degree of negative correlation

In certain circumstances, some of the respondents left a number of questions unanswered. As a result, the required observations were missing and therefore given a distinctive code by the SPSS analysis. These missing data were excluded outright from the analysis of the questions concerned.

3.8.0: Reliability of the Questionnaire

To test the reliability of the responses obtained in the questionnaire, two of the questions contained in the questionnaire were worded in different ways and were placed under different sections of the questionnaire to see whether or not the responses were consistent. The two pairs of questions concerned are shown below:

A.

		5 Greatly Increases	4 Increases	3 Neither Increases Nor Decreases	2 Decreases	1 Greatly Decreases
B27	The use of ICT tools and techniques .....the quality of my audit tasks	☐	☐	☐	☐	☐

WAS = 4.31

		5 Strongly Agree	4 Agree	3 Neither Agree Nor Disagree	2 Disagree	1 Strongly Disagree
C16	The refusal of an audit firm to use ICT tools and techniques could lead to low quality audit	☐	☐	☐	☐	☐

WAS = 3.87

B.

		5 Greatly Increases	4 Increases	3 Neither Increases Nor Decreases	2 Decreases	1 Greatly Decreases
B28	The use of ICT tools and techniques ..... the cost of my audit tasks	☐	☐	☐	☐	☐

WAS = 2.69

C34. The use of ICT ..... the audit fees.

5 Greatly Increases	4 Increases	3 Neither Increases Nor Reduces	2 Reduces	1 Greatly Reduces
☐	☐	☐	☐	☐

WAS = 3.17

It could be observed that these two pairs of questions used in assessing the reliability of the responses from the questionnaire generated similar WAS. From the first pair, question B27 generated a WAS of 4.31 which indicates a +0.31 from the mean for increases (4) while question C16 produced a WAS of 3.87 which indicates a -0.13 from the moderate agreement mean (4). Similarly, question B28 generated a WAS of 2.69, that is, -0.31 from neither agree nor disagree while question C34 produced a WAS of 3.17 which represents a +0.17 from neither agree nor disagree view. Both pairs can be said to present virtually the same viewpoints as their WAS are $\pm$ 0.30 from the opinion points (and less than 0.50 apart in each case) thereby indicating the same direction of agreement level.

3.9.0: Secondary Data

Secondary data sources included relevant books and journal articles for theoretical perspectives and prior results of empirical research relevant to this study. Also, accounting news magazines, reports of committees and research/study groups set up by various professional accounting bodies and regulatory institutions in the

United Kingdom, the United States, Canada, Australia and New Zealand were used to assess the efforts made so far on the implications of ICT for audit practice and recent pronouncements on auditor independence as well as for the Audit Expectations-Performance Gap (AEG). The worldwide web and educational libraries within the East Midlands were equally useful for this purpose. All these sources provided the researcher with a broad-based understanding of the current situations, arguments, debates and developments on the subject of the investigation which helped in adequately contextualising the data obtained from the survey in a way that will be suitable for meaningful analysis as well as suitable theoretical engagement.

3.10.0: Limitations of the Methodology

The main advantages of the relativism position are the ability to use multiple sources of data and perspectives which enable generalisation beyond the frontiers of the situation under study. The weaknesses of the approach centre on the large samples that may be too costly to collect, especially if the research is not being funded.

Due to the sensitive nature of the information being sought as well as the sea of competition that surrounds the activities of the firms and companies involved in the study, it was not easy to gain access to the targeted organisations or to persuade the interviewees to talk about something they considered a Critical Success Factor (CSF) of their business such as ICT. Nonetheless, efforts were made to secure access through certain key members of some of the target organisations (especially through contacts established during workshops, seminars and conferences attended by the researcher at the early stage of the study). Also, it was in order to facilitate this that the ethical and thesis confidentiality approvals were sought and obtained from the university authority as a form of assurance to the organisations and individuals involved of absolute anonymity and confidentiality as well as judicious use and control of the data obtained.

In addition, due to the nature of the data obtained through the questionnaire, there was a large difference in the responses for the main categories of variables to be compared (with one set being less than 10 and the other set being above 50) after re-coding the responses for most of the variables to be tested. This implied that a t-statistic would have been needed for the former and a z-statistic for the latter. As there is no evidence in the literature for the combination of both statistical techniques (t-statistic and z-statistic), crosstabulation and correlations were the only feasible methods of analysis available. These methods, however, did not determine causation. A further limitation is that the WAS, being an average, could be ambiguous in some conditions. For example, a mid-point WAS (close to 3.0 out of 5) might have been generated as a result of a highly polarised situation where there are almost equal numbers of agreeing and disagreeing opinions. These situations have been highlighted wherever appropriate in the data analysis.

As discussed earlier in this chapter, a brief analysis of the past related research works showed that some other methods, such as experiment, case study, ethnography and action research could also have been useful for the study. The case study would have equally involved an empirical investigation of the research problem within its real life context using multiple sources of evidence in such a way that it could answer the what, why and how questions while the grounded theory approach would have been useful in theory building (inductive) assuming there were no existing theories suitable for investigating ICT impact or the existing ones were not sufficient.

However, ethnography and action research would have been too time consuming and expensive for a study that is time bound such as this. Similarly, an experiment would have been difficult given the nature of the activities of the research subjects (time pressured and always struggling to meet one deadline or another). Furthermore, the case study approach was not used because none of the organisations contacted was willing to sacrifice their staff time for research of this

magnitude. In addition, such an approach would not be suitable for the contingency framework being adopted for the study. Therefore, the triangulation of interview and questionnaire carried out on auditors working in diverse organisational settings as the chosen methodology seems most appropriate for a research work of this nature.

In a longitudinal approach to data collection, research data of a particular study are gathered repeatedly from the same or similar sources at regular intervals over a fairly long period of time (Saunders, et al., 2003; Remenyi et al., 1998). This approach would not have been the most appropriate for this study because of the dynamic nature of the ICT environment. Nonetheless, funds and time limitations as well as respondents' continuous participation would be the main factors militating against this approach.

3.11.0: Conclusion

This chapter has shed light on the methodical approaches and procedures involved in collecting relevant data that could yield meaningful results and worthy conclusions capable of moving the frontiers of knowledge forward in the area of audit automation. The chapter shows how the combination of a semi-structured interview and questionnaire could be used to collect useful sets of research data from thirty-six organisations of diverse nature, size and environment.

The next chapter centres on the analysis of the questionnaire and the interview questions and the results obtainable therefrom. This then leads into a discussion of the key issues from which some significant conclusions will be drawn.

CHAPTER FOUR

DATA ANALYSIS I:

CURRENT IMPLICATIONS OF ICT FOR AUDITING

4.0: Introduction

This chapter presents an analysis of the primary data collected through a qualitative (semi-structured interview sessions) and a quantitative (detailed questionnaire) research instrument in order to assess the current impact of ICT on auditing and auditors while the next chapter discusses the likely future directions. Responses to the interview questions have been collated according to the similarity of views and discussed along with the inferences drawn based on the strength and logic of the arguments. Univariate and bivariate analyses have been carried out on questionnaire responses and combined with the interview analysis to evaluate the relevant propositions and reach appropriate conclusions.

4.1.0: Analysis of Participating Organisations

4.1.1: Type of Business

	Questionnaire		Interview	
	Frequency	Percent	Frequency	Percent
Accounting Firm	42	56.8	6	35.3
Manufacturing	7	9.5	0	0.0
Service Oriented	5	6.7	5	29.4
Public Sector	20	27.0	6	35.3
Total .	74	100.0	17	100.0

Table 4.1: Type of Business

Note that 17 auditors are considered in this section of the analysis as one "big4" firm only agreed to participate as an institution rather than allowing firm employees to comment on an individual basis.

The table above indicates that auditors from accounting firms responded more than their colleagues in other types of business. As mentioned in the methodology chapter (chapter three), gaining access to manufacturing organisations was extremely difficult. As a result, the study could only rely on respondents from the business types that agreed to participate, that is, accounting firms of varying sizes, public sector organisations and a few other service-oriented and manufacturing organisations as shown in table 4.1 above. While respondents from accounting firms represent the external auditors, those from other service and manufacturing organisations represent the internal auditors thereby providing some balance between the two classes of auditors.

4.1.2: Category of Organisations

	Questionnaire		Interview	
	Frequency	Percent	Frequency	Percent
Small Organisation	3	4.1	0	0.0
Large Organisation	26	35.1	11	64.7
Other Accounting Firms	21	28.4	0	0.0
"Big4"	24	32.4	6	35.3
Total	74	100.0	17	100.0

Table 4.2: Category of Organisation

Although the organisations that participated in the study were not randomly selected for the reasons explained in the previous chapter, it turned out that, as in the case with participating organisations in the interview, most of them were large organisations and large accounting firms that could afford to use ICT in their audits. However, the fact that other categories participated in the study through the

questionnaire survey as shown in table 4.2 above makes it feasible to test one of the proposed contingent variables of audit automation, the size of organisations.

4.2.0: Analysis of Respondents

4.2.1: Gender

	Questionnaire		Interview	
	Frequency	Percent	Frequency	Percent
Male	52	70.3	10	58.8
Female	22	29.7	7	41.2
Total	74	100.0	17	100.0

Table 4.3: Respondents' Gender

Although more male auditors participated in the questionnaire survey than female auditors, the disparity between the two genders is not as pronounced in the case of the interview.

4.2.2: Class of Auditor

	Questionnaire		Interview	
	Frequency	Percent	Frequency	Percent
External Auditors	43	58.1	6	35.3
Internal Auditors	31	41.9	11	64.7
Total	74	100.0	17	100.0

Table 4.4: Class of Auditors

For the questionnaire survey, more external auditors participated compared with internal auditors, but in the case of interview more internal than external auditors took part.

4.2.3: Work Experience

	Questionnaire		Interview	
	Frequency	Percent	Frequency	Percent
1 - 5 yrs	26	35.1	4	23.5
6 - 10 yrs	12	16.2	8	47.1
11 - 15 yrs	15	20.3	3	17.6
16 - 20 yrs	9	12.2	1	5.9
21 yrs and above	12	16.2	1	5.9
Total	74	100.0	17	100.0

Table 4.5: Respondents' Work Experience

Table 4.5 above indicates that respondents' work experience as auditors spans through all the year ranges. However, more auditors with less auditing experience participated in the study compared to those with substantial auditing experience.

4.2.4: Length of Experience in Current Post

	Questionnaire		Interview	
	Frequency	Percent	Frequency	Percent
Less than 1 yr	15	20.3	2	11.8
1 - 3 yrs	33	44.6	8	47.0
4 - 6 yrs	15	20.3	5	29.4
7 - 9 yrs	7	9.4	2	11.8
10 yrs and above	4	5.4	-	-
Total	74	100.0	17	100.0

Table 4.6: Respondents' Length of Experience in Current Post

The table above shows that the majority of the participants in the study have been in their current audit position for one to three years while those that have been in their current position for up to a decade and beyond were very few. The reason for this might not be unconnected with the abundance of competitive job opportunities

within the accountancy profession. In most cases, it is either a case of promotion within the same establishment to retain and motivate the good hands or a tempting offer from elsewhere.

4.2.5: Age

	Questionnaire		Interview	
	Frequency	Percent	Frequency	Percent
18 - 24 yrs	7	9.5	1	5.9
25 - 34 yrs	34	45.9	4	23.5
35 - 44 yrs	23	31.1	7	41.2
45 - 54 yrs	9	12.2	4	23.5
55 yrs and above	1	1.3	1	5.9
Total	74	100.0	17	100.0

Table 4.7: Respondents' Age

The age distribution of respondents that participated in both the interview and the questionnaire survey indicates that a majority of the respondents (more than 70%) fall within the 25 to 44 age range. This appears to be the most active age group in any professional setting. This indication sheds more light on why 71.6% of the respondents have less than 16 years relevant working experience as auditors (see table 4.6 above).

4.3.0: Detailed Analysis of Responses

The analysis of all the data has been carried out in the sequence of the research propositions stated in the previous chapter. The analysis made use of both respondents' and interviewees' views to draw conclusions on the propositions. These conclusions are further discussed in the light of the study's theoretical underpinnings, in comparison with previous studies and in relation to their implications for audit practice.

4.3.1: Proposition I: ICT Has Had a Positive Impact on Auditing

As the positive impact of ICT is felt on virtually all aspects of human endeavour including business, this proposition evaluates the positive and negative impacts of ICT on auditing. To achieve this purpose, the areas of the research instruments on the following themes shall be explored:

I. Auditors' current level of use of ICT tools and techniques
II. Organisations' current level of ICT provisions for audit purposes
III. Current Benefits and Drawbacks of ICT Use in Audits
IV. The usefulness of ICT to audit steps, tasks, efficiency and effectiveness

The first three themes above are able to explore the current state of affairs regarding auditors' use of ICT tools and techniques in their audit works. They are meant to serve as the pivot upon which the last theme shall rotate in order to have a meaningful conclusion on the proposition.

4.3.1.1: Auditors' Current Use of ICT Tools and Techniques

26% of the respondents rate their ICT skills as being adequate, 37% rate their skills as being good, 19. 2% consider theirs as being very good while the rest (17.8%) rate their ICT skill as either basic or very basic. This Indicates that the majority of modern auditors consider themselves ICT cognisant vis-à-vis their professional responsibilities. This should not be surprising as it will be extremely difficult if not impossible for a 21st century auditor to fail to be proficient in the use of ICT tools and techniques. This result is further strengthened by the fact that 76.7% of the respondents have access to a laptop while 19.2% have an unshared PC for their audit tasks. Added to these, 97.3% have access to online facilities while 75.7% have access to an official mobile telephone for effective communications in the course of their audit assignments (questions B1 to B4). In addition, 86.0% of the respondents agree that their access to internet facilities aids their audit tasks considerably (question C3). However, respondents' views were polarised but slightly positive on how helpful their organisation's website could be

to their audit tasks as 47.2% agreed, 27.8% neither agreed nor disagreed while 25% disagreed (question C1 - C2).

Furthermore, 94.4% of the questionnaire respondents believe that ICT improves the quality of their audit work (question B27), while 72.9% believe that the refusal of an audit team to use ICT could lead to low quality audit (question C16). Similarly, 83.1% believe that the use of ICT in audit engagements seems unavoidable to auditors if they aspire to achieve an effective audit in today's business world (question B26). In addition, 76.1% agree that the use of ICT for their audit tasks gives them a comparative advantage over their colleagues who don't use ICT as much (question B19). Moreover, 88.8% of respondents agree that ICT makes their performance more satisfactory (question C17).

65.3% of the respondents expressed the view that ICT is a major aspect of their mandatory continuous professional education while 77.9% are satisfied with their organisation's provision of appropriate ICT training for them as auditors (questions B17 -18).

4.3.1.2: Organisations' Provision of ICT for Audit Purposes

The responses from question B16 (the following are the packages currently provided by my organisation for audit purposes) show that all the "big4" and some medium sized firm have their own proprietary audit packages while most of the small firms and the internal audit departments either use solely the general packages such as IDEA, AS/2 and Galileo or combine the general packages with some adaptations of the "big4" proprietary packages. Furthermore, some of the "big4" have software for certain administrative aspects of the audit. These include software for claiming expenses, recording time spent on engagements and billing clients among others. This conforms with the findings of Manson et al. (1997) which indicate that only large and medium sized accounting firms use ICT extensively in their work.

> *"..... in the early 1990s the "Big Six" firms were spending considerable amounts on the development and implementation of audit automation ..... the "Big Six" firms used IT in the audit process more extensively than the other firms"* (Manson et al., 1997:15).

Added to these, only 56.3% of the respondents are satisfied with their organisations' provision of ICT based decision aids, 76.7% are satisfied with their organisations' provision of KBES while 78.9% are satisfied with their organisations' provision of general ICT packages.

65.2% of respondents claim that their respective organisation has its own in-house designed audit packages while 33.3% claim that their organisations do not while others are unsure (question C7). Also, 85.1% of the respondents believe that ICT strengthens the internal control system of their/their clients' organisations (question C33). In spite of Bell et al.'s (1998) opinion that an auditor's understanding may be lacking when applied to technology-based information systems, this study indicates that auditors' use of ICT systems does strengthen their firms'/organisations' internal control systems.

Furthermore, 69.4% of the respondents claim that their respective organisation upgrades audit packages every one to two years while 31.8% of the respondents claim that their respective organisations introduce a new audit package once every 2 to 3 years (questions C37 and C38).

82.1% of the respondents argue that ICT gives their organisations a comparative advantage over their competitors who use less ICT (question C20), 75.7% believe that their organisation's investment in ICT is justified given its level of performance (question C4), 67.4% believe that their organisation's investment in ICT is justified given its level of client/customer retention (question C5) while 81.9% believe that

their organisation's investment in ICT is justified given its size/level of expansion (question C6).

With respect to auditors' relations with their clients, superiors, subordinates, colleagues and management, not less than 67.1% of respondents agreed that the use of ICT tools and techniques has brought about positive developments (questions C11-15). However, only 53.5% of the respondents agreed that the use of ICT tools and techniques enhances their commitment to their organisations' goals, 36.6% neither agreed nor disagreed while 9.9% disagreed (question C18).

4.3.1.3: Current Benefits and Drawbacks of ICT Use in Audits

The interview data and responses to question B32 of the questionnaire regarding ICT's contribution towards the efficiency and effectiveness of audit emphasise the following: accuracy, adequacy of documentation, consistency and quality of working papers, possibility of timely identifications of errors, thoroughness, reliability and ease of linking current to the previous year's work. These findings tally with those obtained from earlier studies (Fischer, 1996; Brown, 1991; Wilson and Sangster, 1992; Manson et al. 1997).

They also indicate that ICT ensures consistency in the application of the audit approach across audit teams, audit assignments and audit locations thereby breeding standardisation. Moreover, it could be observed that these benefits, consistency and standardisation, are enhanced in both internal and external audit functions. Also, both internal and external auditors believe that using ICT tools and techniques in their audit tasks has positively affected their attitudes to work within the context of their professional performance as shown below.

C39. The use of ICT tools and techniques sometimes affects my attitude to work within the context of my professional performance.....

	3 Negatively	2 Positively	1 Neither Negatively Nor Positively
F:	4	36	23 = 63
WS (W*F):	12	72	23 = 107
F (%):	6.3	57.1	36.5 = 100
WAS:	**107/63 = 1.70**		

This finding matches that of Manson et al. (2001) which suggested that audit automation affects auditors' attitudes to work. There is a link between this result and the one obtained on ICT's impact on audit quality, efficiency and effectiveness as discussed in the first proposition. The results from the proposition shows a positive impact and this might elicit a positive attitude on the part of auditors in relation to their audit works.

Regarding the current drawbacks of ICT use in audits, the findings of the study signify that the cost implication of audit automation is a major cause for concern to both internal and external auditors. It also shows that auditors learn more ICT use on the job than from formal training as most of the organisations barely provide adequate formal training. This might be as a result of the financial implications and workload of the auditors. This finding is in harmony with the findings of Manson et al. (2001) and Flesher and de Magalhaes (1995) who identify cost and training/inadequate expertise as the main limitations of ICT use by auditors. A similar stand was aired by Carr's (1987) findings when he put forward the idea that in small firms, there is a shortage of ICT skills and ICT development strategy, a reluctance to train and involve staff and to quantify benefit while large firms lack internal expertise and are sceptical of benefits.

As it is the case with the general use of ICT tools and techniques in audit, the study's data show that the appropriate technology to support real time audit review (from the audit firms' and their clients' point of view) might be lacking. Yet, all three respondents who made this point are from the participating "big4" accounting firms who should ordinarily have the wherewithal in terms of resources and appropriate clientele to implement real time audit review.

Other drawbacks obtained from the study include firms' struggle to keep pace with ICT growth, overreliance on ICT by auditors, ICT encouraging process auditing (rather than a holistic approach), auditors' conservative attitude towards change, clients' low level of computerization, fear that ICT overemphasises form filling, inadequate infrastructures to support ICT, health hazards and lack of personalization (due to the regimentation of the entire process).

Using the foregoing discussions (on the first four themes) as the foundation for the proposition, the fifth theme can now be investigated.

4.3.1.4: The Usefulness of ICT to Audit Steps, Tasks, Efficiency and Effectiveness

As regards the audit process, the interviewees identified three key areas that benefit most from ICT's impact. These are the planning and management of the audit, data analysis and communications and information flow among audit team members and between auditors and their clients as well as third parties.

At the planning stage of the audit, auditors are required to make a lot of contacts with the appropriate members of the client's management team, review previous years' work, gain relevant knowledge of the business and the industry in which the client operates and budget for timing, human and material resources that the engagement might require. Management of the audit requires the implementation of the audit plan in a way that enables the auditors to deliver at the right time and in

the right manner through the audit program. Therefore, ICT has been seen to be of great help in these tasks.

An IT audit manager with a UK city council confirmed this view in the following quote:

"Recently, we adopted an electronic working paper called the TeamMate by PricewaterhouseCoopers, if you are aware of it. It can be used to record audit programs. You can go away and ask a lot of questions to the audit team and prepare an electronic working paper. From there you can generate an exceptions report and recommendations for the audit and you can also generate alternative reports. This can be helpful in planning and managing the audit as well as risk assessment".

Secondly, the area of data analysis is crucial for any audit assignment as significant audit opinions can only be formed after the figures have been well scrutinised and evaluated. Examples of such audit opinions are determining the going concern status of an organisation and assessing an organisation's position within the industry.

"Analysing data, especially performing an analytical review, is greatly enhanced by ICT. You can't do a lot of analytical review using the traditional technique. You do need computer facilities to crunch your numerous records. You will always get a better insight by using computer-based data analysis techniques".

- An audit executive with "big4"(b)

It is indicated from the quote above that ICT is extremely useful in data analysis as this constitutes a tedious exercise when carried out manually when there is a large volume of data requiring review and testing. It also means that a greater amount of analysis can be carried out which will generally reduce audit risk as ICT techniques

make it possible to scrutinise the entire population of a dataset rather than selecting just samples. Also, the level of accuracy is expected to be high with ICT packages and templates.

From both the preparation and presentation perspectives, audit reporting also enjoys the use of ICT facilities. In fact, the recent developments in Internet Reporting make ICT indispensable in audit reporting (Lymer, 1997; Beattie and Pratt, 2003).

Furthermore, information is only useful when it is capable of being communicated to the appropriate party at the appropriate time through the appropriate channel. Digital and online technologies play a crucial role in generating, storing and communicating information effectively. This is supported by the following statement from a senior manager with "big4"b:

"It makes it easier to share information among team members given the fact that people work on a number of engagements in different locations. This means they can share information a lot quicker as a file can be readily available as and when required. The telecommunication aspect of ICT enables audit effectiveness. It makes it a lot easier to walk away from the office and still be reached. ICT's ability to connect people together is a tremendous benefit to the practice".

Table 4.8 below on the aspects of ICT most used in the audit process shows that the above line of thought tallies very well with the responses from the questionnaires as the same issues are identified by both the interviewees and the respondents.

Question B11: The following are the aspects of my audit tasks in which I find ICT most useful (in order of priority)

Audit Task	No of Respondents	% of Total Responses to the Question (69)
Data Analysis and Interrogation	43	62.3%
Reporting	43	62.3%
Planning	41	59.4%
Communicating	37	53.6%
Recording and Documenting	30	43.5%
Preparing F/Statements and Verifying Ledgers	13	18.8%
Controlling	11	15.9%
Analytical Review	8	11.6%
Researching Clients	8	11.6%
Assessing Risk	7	10.1%
Verifying Processing Logic	5	7.2%
Storing Data	5	7.2%
Illustrating Findings and Presentations	5	7.2%
Standard Schedules	4	5.8%
Managing	4	5.8%
Monitoring	3	4.3%
Electronic Disclosure Checklists	3	4.3%
Sample Selection	3	4.3%
Reviewing the Work of Others	2	2.9%
Tracking Audit Recommendations/Follow Up	2	2.9%
Testing	2	2.9%

Table 4.8: Question B11 (Questionnaire)

The analysis of the open-ended questions also attempts to identify the aspects of the audit process that attract the least use of ICT (question B12). These, according to table 4.9 below, are interfacing with the clients, administrative tasks, managing audit staff, physical verifications and expressing opinions.

Question B12: The following are the aspects of my audit tasks in which I find ICT least useful (in order of priority)

Audit Task	No of Respondents	% of Total Responses to the Question (48)
Interfacing with clients (meetings, interviews)	10	20.8%
Administrative tasks and managing staff	8	16.7%
Physical verifications (invoices, vouchers and stubs)	6	12.5%
Expressing opinions	6	12.5%
Assessing risk	5	10.4%
Analysing control systems	5	10.4%
Cross referencing between working papers	5	10.4%
Planning	3	6.3%
Controlling	3	6.3%
Substantive testing	3	6.3%
Review of paper files	3	6.3%
Detection of fraud and money laundering	2	4.2%

Table 4.9: Question B12 (Questionnaire)

Questions B5 to B10 focus on auditors' view on ICT's impact on six stages of the audit process as shown below:

		4 Always	3 Usually	2 Sometimes	1 Never
B5	I use ICT tools and techniques in the planning of my audit assignments	☐	☐	☐	☐
B6	I use ICT tools and techniques in the recording of my audit tasks	☐	☐	☐	☐
B7	I use ICT tools and techniques in the data analysis of my audit tasks	☐	☐	☐	☐
B8	I use ICT tools and techniques in the controlling of my audit tasks	☐	☐	☐	☐
B9	I use ICT tools and techniques in the reporting of my audit tasks	☐	☐	☐	☐
B10	I use ICT tools and techniques in the internal communications within my firm/department	☐	☐	☐	☐

The frequency tables for the six stages generate WAS between 3.33 and 3.70 out of 4 (see appendix E), signifying a response pattern that is between '*usually*' and '*always*'. This indicates auditors' high use of ICT tools and techniques in the planning, recording, analysis, controlling, reporting and internal communication of their audit assignments. Furthermore, crosstabulations are used to assess whether these responses have any association with the overall level of ICT use by the respondents. Therefore, the above six variables (questions B5 to B10) are matched with the responses to question B30 below:

For my audit assignments, I utilise.....

3 More ICT Techniques than Manual Techniques	2 More Manual Techniques Than ICT Techniques	1 Equal Proportion of ICT and Manual Techniques
☐	☐	☐

The matchings produced six different but identical crosstabulations as contained in tables F1 to F6 of appendix F. Placing emphasis on the 'usually' and 'always'

columns (questions B5 to B10) in relation to those who use more ICT and those who use more manual techniques, the six crosstabulations in appendix F (pages i - iii) can be compressed to draw out the salient conclusions as follows:

	More ICT Than Manual		More Manual Than ICT		Inference
	Frequency	Percent	Frequency	Percent	
Planning	45 out of 47	95.7	7 out of 8	87.5	No Association
Recording	45 out of 47	95.7	7 out of 8	87.5	No Association
Data Analysis	46 out of 47	97.9	5 out of 8	62.5	Weak Association
Controlling	44 out of 47	93.6	5 out of 8	62.5	Weak Association
Reporting	47 out of 47	100	7 out of 7	100.0	No Association
Internal Communications	41 out of 46	89.1	6 out of 8	75.0	No Association

Table 4.10: The Audit Process and Respondents' Level of ICT Use

Table 4.10 shows that there is no relationship between auditors' level of ICT use and their use of ICT tools and techniques in the planning, recording, reporting and internal communications of their audit tasks while there is a weak but positive relationship between auditors' level of ICT use and their use of these tools in their data analysis and controlling. This implies that whether auditors use more ICT techniques than manual techniques or more manual techniques than ICT techniques in their audits they are likely to use the same level of these tools and techniques in the planning, recording, reporting and internal communications aspects of their tasks. However, auditors who use more ICT techniques than manual techniques are more likely to use more ICT tools and techniques in their data analysis and controlling compared to their counterparts who use more manual techniques than ICT techniques in their audits.

Furthermore, certain variables can be introduced to assess the responses on the usefulness of ICT in different aspects of the audit process tested in the crosstabulations above. These variables are class of audit, age, work experience

and gender. This is in order to determine whether these variables have effects on respondents' views in the questionnaire. The crosstabulations for this purpose are shown in tables F7 to F30 of appendix F.

Again, placing emphasis on respondents that chose 'usually' and 'always' on the Likert scale to questions B5 to B10, these crosstabulations (in pages iv – xv of appendix F) can be summarised thus:

		Planning %	Recording %	Analysis %	Contro-lling %	Repor-ting %	Internal Comm. %
Class of Auditor	External	97.6	88.1	92.9	81.0	100.0	90.5
	Internal	83.4	100.0	83.3	86.6	96.7	82.2
Age	25-34 yrs	93.9	90.6	87.9	72.7	96.9	97.0
	35-44 yrs	95.5	100.0	95.5	90.9	100.0	68.2
Work Experience	1-5 yrs	88.0	95.8	96.0	80.0	95.8	96.0
	6-10 yrs	91.7	75.0	75.0	66.7	100.0	91.7
	11-15 yrs	100.0	100.0	100.0	85.7	100.0	85.7
Gender	Male	92.1	94.0	88.2	82.4	98.0	84.0
	Female	90.5	90.5	90.5	75.7	100.0	90.5

Table 4.11: The Audit Process and Auditors' Attributes

Table 4.11 above reveals that with the exception of recording and controlling audit tasks, external auditors find ICT tools and techniques more useful in their audit process than internal auditors, respondents in the age bracket of 35 to 44 years use more ICT in their audit process compared to those in the age bracket 25 to 34 years except in internal communications. As a corollary of this, the summary table above indicates that except in the aspect of internal communication, auditors with relevant auditing experience of between 11 and 15 years use ICT tools and techniques in their audit process more than auditors who fall under other experience ranges. This is In contrast to the findings of Abdolmohammadi and Usoff (2001) which suggested that highly experienced auditors are more likely to

prefer human processing to decision aids' (a form of ICT technique) use in carrying out their audit tasks and the use of ICT appears to be increasingly taken up by more senior professionals. Furthermore, the pattern shows that auditors' class (internal or external) and gender are not determinants of the volume of ICT auditors might use in their task process.

From the above, we can conclude that ICT has impacted positively on the audit process particularly in the areas of data analysis, reporting, recording, planning and communication. This conclusion confirms the findings of Manson et al. (1997) which indicated that ICT *"was used for planning, controlling and recording tasks within the audit process"*. The only slight difference between the two results is that Manson et al.'s (1997) study placed more emphasis on different aspects of recording audit tasks and did not extend the audit process to cover areas such as data analysis and reporting.

The efficiency of any system is evaluated by speed and cost. *Ipso facto*, the impact of ICT on audit efficiency should be gauged based on the time it will take to complete an automated audit engagement and the cost implications of such engagements. Virtually all the interviewees agreed that the use of ICT tools and techniques such as audit software, DSS and KBES speeds up audit tasks. According to an assistant audit manager with a UK city council,

"The main benefit is in speeding up of the reporting process and also providing more integrity in the data being examined so that one can actually download information and quickly analyse it".

Also, ICT's ability to speed up the completion of an audit assignment can be viewed from the perspective of the current ubiquitous nature of online mechanisms which has enabled the use of real-time audit review and continuous auditing. In the words of two of the interviewees from "big4"(b)

"Works could be carried out from different locations. Auditors don't have to be together. Sometimes, you don't need to spend more than one hour with a client, but you have to travel all the way there. So, real-time audit review saves you time. Also, a lot of clients have locations in different areas up and down the country. It can be easier to interact with them all because they are all connected together. This is a lot better than phone which can take time before explanations are understood correctly".

"Through the use of real-time accounting, if you see any problems occurring, you can identify and correct them straightaway. Besides, as is customary with audit assignments, you are always looking back twelve months and try to follow what happens to meet the problems and real time system is very useful to you as an auditor in this circumstance. Everything is not left until year end especially in <a> continuous auditing system. Therefore, you can provide a better assurance over them".

Despite the time advantage brought about as a result of audit automation both the initial cost involved in the configuration of ICT systems as well as its running cost might sometimes be challenging.

"<ICT> is also expensive in terms of set up costs, maintenance and continuous development to remain valuable".

- The chief auditor of a UK "big7" bank

Moreover, the more technologically sophisticated an audit firm intends to be, the more it should be prepared to invest in ICT tools and techniques. Therefore, advanced audit techniques such as COA and real-time audit review might involve huge financing as evidenced by the following two comments:

"COA requires constant monitoring, therefore might consume more time and money".

- An auditor with "big4"(b)

"Although this [real-time audit review] could be an advantage because there is a remote working environment unlike ours but again it will probably need appropriate equipment in the field for auditors to be able to do work with it. Invariably that might be costly".

- An assistant audit manager with a city council

Question B28 of the questionnaire reproduced below generates a WAS of 2.69 from the frequency table (see appendix E). This result shows that respondents' views were polarised between 'increases' and 'decreases' the overall audit costs.

		5 Greatly Increases	4 Increases	3 Neither Increases Nor Decreases	2 Decreases	1 Greatly Decreases
B28	The use of ICT tools and techniques ..... the cost of my audit tasks	☐	☐	☐	☐	☐

Although the interview excerpts indicate that the use of ICT speeds up the audit tasks, makes audit tasks easier to perform and enables remote working for auditors through real-time audit review, auditors believe that the cost of implementing, maintaining and upgrading ICT facilities could be quite substantial. This concurs with Manson et al. (1997):

"It had been expected that cost reductions were the main motivation for introducing audit automation.....Overall, the respondents and interviewees ..... did recognise, however, that financial cost was a barrier to achieving the full potential of audit automation".

Another main drawback of using ICT in audit as identified by a cross-section of the interviewees is the difficulty in downloading clients' data. This was seen as an area of major obstacles bringing about some time delays and attendant costs. This can be demonstrated by the excerpts below:

"Another <problem> is the incompatibility of the systems in terms of downloading clients' data into your own system. This is always a tedious exercise. It takes a lot of time and you know time costs money".

- An assistant audit manager with a city council

"The biggest problem is getting the data from clients in a format you can use. I'm speaking from personal experience. That always takes the longest time".

- An audit executive with "big4"(b)

It would be safe to conclude that the use of ICT tools and techniques has had a positive impact on audit efficiency in terms of time saving but this needs to be balanced with cost considerations.

Audit effectiveness is understood to mean the ability of the audit to achieve its primary purpose. For the purpose of this analysis, audit effectiveness is measured from the point of view of quality, thoroughness, consistency and reliability. These can easily be achieved through the high level of accuracy obtainable from computerised techniques. Also, these techniques are capable of processing large volumes of data without any mark of distinction between the first and the one thousandth items. This is not in any way comparable to the traditional manual techniques whereby auditors can suffer physical and mental fatigue. These points are alluded to in the following comment:

"The main advantage is that it is reliable and comprehensively covers the systems to audit. There is also the advantage of thoroughness of audit testing. You can use

ICT to test, for example, an entire population as opposed to small samples. There is, therefore, a kind of reliability assurance in the sense that if you are careful in setting things up, you can minimize the risk of human errors".

- An audit manager with a city council

In addition, the ability of ICT tools and techniques to enable auditors to access and interrogate their clients' records and perform various forms of tests and analyses enhances audit effectiveness by increasing the auditor's ability to detect errors and omissions. This assertion is supported by the following interview excerpts:

"It enables detailed interrogation of clients' systems and enhances the potential for identifying errors. It also eliminates problems associated with handwriting".

- An institutional response with "big4"(a)

"The main benefit is that you have the ability to interrogate the whole of the data whereas, in the manual approach, you are restricted to sampling. ICT identifies trends over the whole population and accuracy is always ensured".

- An audit executive with "big4"(b)

The questions relevant to audit effectiveness in section C of the questionnaire are those relating to ICT's impact on audit evidence, performing audit testing, audit quality and audit trails reproduced below:

		5 Strongly Agree	4 Agree	3 Neither Agree Nor Disagree	2 Disagree	1 Strongly Disagree
C16	The refusal of an audit firm to use ICT tools and techniques could lead to low quality audit	☐	☐	☐	☐	☐
C26	The use of ICT tools and techniques makes my audit tests easier to carry out	☐	☐	☐	☐	☐

		5 Much Easier	4 Easier	3 Neither Easier Nor More Difficult	2 More Difficult	1 Much More Difficult
C30	The use of ICT tools and techniques makes it .....to gather sufficient audit evidence	☐	☐	☐	☐	☐
C31	The use of ICT tools and techniques makes it ..... to gather reliable audit evidence	☐	☐	☐	☐	☐
C32	Audit trails are ..... to access in an entity with a computerised accounting system as compared to an entity without a computerised system	☐	☐	☐	☐	☐

The frequency tables for these questions produced a WAS of between 3.83 and 4.09 (see appendix E). This shows that respondents tend to agree that audit automation has enhanced auditors' ability to gather reliable and sufficient audit evidence, perform audit tests, access audit trails and provide quality audits. This is a positive impact and substantiates the observation by Manson et al. (1997) which stated that:

> *"It had been expected that cost reductions were the main motivation for introducing audit automation. However, the results of the survey showed this to be second to improving audit quality".*

The variables above are equally matched with question B30 from the questionnaire to establish if there is a link between auditors' level of ICT use and their opinions on the usefulness of ICT on audit evidence, performing audit testing, audit quality and audit trails (see tables F31 to F35 of appendix F). Considering those whose responses are in the affirmative from the relevant five tables in Appendix F (pages xv - xviii), these tables are summarised below to draw out the key factors.

	ICT makes it easier to gather **sufficient** audit evidence	ICT makes it easier to gather **reliable** audit evidence	ICT makes it easier to perform audit tests	ICT makes it easier to access audit trails	ICT improves audit quality
Equal level of ICT and Manual Techniques	10 out of 15 66.7%	9 out of 15 60.0%	12 out of 14 85.7%	15 out of 15 100.0%	16 out of 17 94.0%
More Manual Techniques than ICT Techniques	5 out of 8 62.5%	7 out of 8 87.5%	8 out of 8 100.0%	5 out of 8 62.5%	8 out of 9 88.9%
More ICT Techniques than Manual	34 out of 47 72.3%	30 out of 47 63.8%	38 out of 44 86.4%	30 out of 46 65.0%	44 out of 46 95.7%

Table 4.12: Auditors' Level of ICT Use and ICT's Benefits

The patterns obtained from table 4.12 above indicate that there is no relationship between auditors' level of ICT use compared to manual techniques and auditors' view on the usefulness of ICT tools on audit effectiveness. This means that all the respondents irrespective of their current level of ICT use in their audit believe that ICT makes audit tasks more effective.

Despite the above views on the impacts of ICT on audit effectiveness, interviewees were able to point out technological compatibility as a main area where the use of ICT could generate serious difficulties as ICT capabilities in terms of hardware models and software versions can differ between auditors and their clients.

"We once tried using the approach [real-time audit review] with one of our bigger clients but it wouldn't work because the client's system was incompatible with our system".

- An auditor with "big4"(b)

As was the case with the general use of ICT tools and techniques in audit, respondents are of the view that the appropriate technology to support real time audit review (from the audit firms' and their clients' point of view) might be lacking. It is interesting to note that all three respondents that made this point were from the participating "big4" accounting firms who would ordinarily be expected to have the wherewithal in terms of resources and appropriate clientele to implement real time audit review.

Concerns were equally raised regarding the security of data files being processed by the auditors as the possibility exists that these could be assessed and tampered with by unauthorised parties. This is capable of affecting the clients' operations and financial and information systems as shown in the excerpt below.

"A lot of the stuff we communicate on is probably confidential and if others access it, it can be significantly consequential to the client. There is also the possibility of system failure".

- An auditor with "big4"(b)

In sum, since the foregoing analysis has been able to show that ICT has benefited the audit process and enhances audit efficiency and effectiveness. It would be therefore correct to say that there has been a positive influence of ICT on auditing. This finding corroborates the views expressed in previous studies on the reasons for the increase in the development and adoption of ICT tools and techniques. These tools were said to be developed in order to improve audit efficiency, effectiveness, quality and economy (Fischer, 1996; Brown, 1991; Wilson and Sangster, 1992; Manson et al. 1997), improving the results of analytical procedures (Dzeng, 1994) and improving decision making (Wright, 1995).

4.3.2: Proposition II: Auditors' Use of ICT Tools and Techniques Renders Manual Techniques Obsolete

There have been arguments and counter-arguments by the proponents of both technological determinism and their social constructivist colleagues regarding a key question, namely, whether it is technology (ICT) or the social actor (humans) that shapes the outcome of events in our modern world. This second proposition is designed to contribute to this debate by examining auditors' use of ICT tools and techniques in their audit assignments.

The interviewees identified three main areas that require a maximum use of ICT tools and techniques as against manual procedures. These are IT audit, audit testing and data mining. IT audit as described in the first chapter concerns using ICT tools and techniques to examine a computerised accounting system in order to test the working procedures and the reliability of such systems. It would be extremely difficult to use any other method to carry out such tasks other than with the use of ICT.

".....yes, in terms of looking inside the computer itself. Nowadays, we don't work around the system, we actually work through the computer system to see if things can go wrong within the processing. In some cases it has been difficult to actually forge ahead without getting through the processing".

- An assistant audit manager with a city council

Also, the use of ICT makes audit testing easier, faster, more accurate and more convenient to carry out. As such, auditors are bound to use more computerised techniques for this rather than tedious manual techniques. The two responses from the interviewees as shown below say it all.

"In a more continuous auditing environment, or one where there are lots of tests of detail to be performed, much of the bulk testing could be carried out using ICT".

- An institutional response from "big4"(a)

"Probably, the tests that we have to carry out. We have a tool here called Microstat which gives us a sample size to test. It considers a lot of factors such as the build up of the clients including control risks".

- An auditor with "big4"(b)

We should recall that audit testing was highly favoured as an audit area that benefits auditing tremendously from the analysis of the first proposition, therefore it is not surprising that this is still presented once more as an area that could be regarded as belonging to the ICT domain.

Also, data mining appears to be the current thinking in artificial intelligence. Data mining is the automated extraction of hidden predictive information from corporate databases using the combination of statistical modelling, database storage and artificial intelligence (Mena, 2003:3). Under this system, computer software packages are designed in a way that can reveal patterns and trends for decision making purposes (Wikipedia, 2005).

On the subject of areas in which ICT and computer based decision tools should not be used, interviewees produced the following viewpoints:

"Data mining and possibly audit planning".

- An Institutional response from "big4"(a)

Nevertheless, interviewees were able to identify three key areas which they believe should not be left predominantly to the use of ICT. These are the areas of judgement and decision making, interviewing clients and making personal

contacts. The issue of decision making revolves round the entire audit process which culminates in the final audit opinion. This view is strengthened by the following excerpts from the interviews:

"All areas of judgement, including the determination of the correct audit approach in any particular audit area. This also includes deciding on whether to accept/continue with a client and determining what needs to be reported to the client".

- An institutional response from "big4"(a)

"Since the judgement determines whether or not there is an audit issue and the magnitude of the issue, I reckon this should be manually carried out rather than using ICT".

- An audit manager with a UK "big7" bank

Moreover, decisions regarding the materiality level to adopt for a particular level might have to do with auditors' knowledge and experience of the nature of the business organisation in question.

"Determining things like errors and materiality I think should be left to human judgement because that is basically made up of your previous knowledge of the client and your cumulative experience as an auditor".

- An auditor with "big4"(b)

Related to this aspect are decisions on the scope and extent of an audit engagement at the planning stage as described by an audit manager with a UK "big7" bank below:

"A significant proportion of manual efforts would be required in determining the scope of a particular audit. I stress significant rather than exclusive".

Since every stage of the audit process requires one form of decision making or another, the responses above indicate that even when auditors use decision aids, they have to use their professional experience and judgement in taking crucial decisions as they are to be held accountable for such decisions and the blame for any wrong decision cannot be pinned on ICT. As suggested in previous studies, using decision aids in arriving at a decision is a double-edged sword as an auditor may be liable for not adequately using a modern decision aid in arriving at a judgement that turns out to be a misstatement just as he may be liable for basing his judgement solely on an expert system to make an incorrect judgement (Ashton, 1990; Sutton et al., 1994).

The second area identified as not being conducive to the use of ICT tools and techniques is interviewing clients. The aim of this exercise by the auditor is to establish some facts or to clarify certain grey areas important for the conduct of audit tasks.

"Interviewing the client to gather information – this will always be more effective when carried out face to face".

- An institutional response from "big4"(a)

In addition, the chief auditor with a UK "big7" bank commented that:

"In interviewing audit clients, ICT could be used to give useful hints of the questions but never to dictate the question because the human mind is evaluating the information all the time. It should not be depersonalised".

This comment indicates that conducting an interview requires a face-to-face approach rather than telephone interview or video links. This is because the skills of the interviewer (auditor) will have to be used to capture the unspoken words inherent in the body language and tone of the interviewee (auditee). This is

expected to guide the auditor in asking certain further probing questions to gain a clearer understanding of the issues he/she is investigating. Although the use of communication media might be allowed in certain extreme circumstances, yet the physical presence approach remains the most potent method available to the auditor.

Personal contacts appear to be a highly significant part of auditing. Some of the responses show that the need for the personal touch on the part of the auditor cannot be overstressed. This is presented as being crucial for a cordial and smooth auditor-client relationship. One of the significant aspects of these contacts is the opportunity it affords the auditor to gain a first hand experience and evaluation of how the client operates its systems. The two responses below capture this.

"Feelings and assessment of the workings within the department and the organisation".

- The chief internal auditor of a UK "big7" bank

"To really understand the client's business, using ICT tools such as e-mail and telephone cannot really suffice. The auditor would need to interact physically with his clients and the clients' business environment".

- A senior manager with "big4"(b)

Another angle to the need for auditors' physical interaction with the clients can be viewed from the social perspective as explanations and crucial information can only be obtained through personal approaches as the two comments below show.

".....a major part of our work is human. You are talking with people, we are dealing with people all the time and because in auditing, at the end of the day you are giving a report, this has a social significance to affect people's lives. We've got

to say that. On top of the report which is being produced using ICT, we are being socially responsible to the shareholders and the public as a whole".

- An assistant audit manager with a city council

"There is also the concept that 'systems are operated by the people and for the people' so, the communications side is very crucial irrespective of the amount of ICT being used".

- An audit manager with a city council

The most relevant question related to this proposition in the questionnaire is B30:

B30. For my audit assignments, I utilise.....

3 More ICT Techniques Than Manual Techniques	2 More Manual Techniques Than ICT Techniques	1 Equal Proportion of ICT and Manual Techniques
☐	☐	☐

This question generates a WAS of 2.42 out of 3, that is, a response that shows that auditors tend to use more ICT tools and techniques in their audit assignments than manual techniques as the frequency table below indicates.

B30: For my audit assignments I utilise .....

Response	Weight	Frequency	Weighted Response	Frequency %
Equal Proportion of ICT and Manual Techniques	1	17	17	23.6
More Manual Techniques Than ICT Techniques	2	8	16	11.1
More ICT Techniques Than Manual Techniques	3	47	141	65.3
Total		72	174	100

Table 4.13: Question B30 (Frequency Table) WAS: 2.42

Table 4.13 above indicates questionnaire respondents find ICT techniques more useful in their audit assignments. However, the majority of the interviewees were of the opinion that most areas of the modern audit would require a combination of both ICT and human efforts. Here are some of their comments:

"Performing complex calculations and data analysis that are often involved in audit tasks could be left for the technology while auditors play the diagnostic role of interpreting and working on the results of the calculations and conclusions. However, auditors cannot really leave the entire process to technology as he has to control and monitor the process (i.e. control-based system). He is to be blamed in case anything goes wrong at the end of the day. ICT remains just an aid..... In sum, you will need to mix the ICT and human element together and get the right balance. In some areas of the audit, ICT would be required and in some other areas, more human elements would be required".

- A senior audit manager with "big4"(b)

"I think there is no area of audit that should be left exclusively for the use of ICT. What I mean by that is ICT tools and techniques should be used as mere tools and techniques by auditors in performing the audit functions. Of course you could perform these functions with or without these tools but using them enhances <a> more thorough, more reliable, [more] quicker and more efficient audit".

- An audit manager with city council

"I think you need both the technology support and human actors in all aspects of audit to achieve the best result".

- An audit manager with a UK "big7" bank

Again, this is one of the few response groups that can be described as a consistent representation of all the respondents that participated in the interview. Responses to this question were the same across all auditors at all levels, both auditor types (internal and external) and all sectors of operation (private and public).

The comments above show that auditors realise that their tasks require both mechanical (technical) and human (social) elements at every stage of the audit. These two components should be carefully integrated as a unified system at every stage of any audit assignment in order to attain the optimal result, a thorough audit that will generate a correct opinion. From the foregoing analysis therefore, this study advocates the socio-technical systems approach to understanding the use of ICT in audits. Under this approach, an audit will be perceived as a string of connected activities that is expected to finally produce a worthwhile opinion i.e. a system. The system is expected to make use of a mix of social actors (including auditors) and technology (ICT tools and techniques) to achieve its purpose. The approach becomes inevitable as the borderline between the technological determinism and social construction of technology paradigms gradually fizzles out. Besides, socio-technical systems theory becomes the only approach that is capable of providing a holistic view of the phenomenon.

The arguments above show that despite the fact that auditors are using more ICT tools and techniques as a result of advances in technology, this cannot render manual techniques obsolete. One can therefore affirm that auditors' use of ICT tools and techniques is complementary to other manual techniques rather than rendering the latter obsolete. This finding expands on the views of Orlikowsi (1992) and Manson et al. (2001).

4.3.3: Proposition III: The Extent of ICT Utilisation for Audit Assignments is Affected by Audit Firms' and Clients' size, Nature of Audit tasks and Auditors' Experience

Xiao et al. (1996) put forward the idea that the application of ICT in the modern corporate financial reporting environment can best be understood using the contingency theory of organisations. This theory advocates that the applicability of ICT tools and techniques is not absolute but relative to the nature of the audit firm's and the client's size, industrial base of the client and the auditor's personality among others. This proposition sets out to test Xiao et al.'s (1996) theoretical proposition in an empirical way.

Virtually all the interviewees that chose to comment on the effect their organisations' size could have on its level of automation totally agreed that size is a critical factor. The following represent some of the opinions expressed:

"Yes, I think if we were bigger, we would automate earlier and on a larger scale".

- The chief auditor of one of the UK "big7" banks

"It probably does. The complexity and size of an organisation determines its level of automation".

- An audit manager with of one of the UK "big7" banks

"Yes, I believe it does, size together with the nature of the clients".

- An IS audit manager with a UK "big7" bank

"Yes, I think we are using more ICT than the smaller firms but within the "big4", I think the level is not that different. It is more <a question> of what the organisation can afford".

- A senior auditor with "big4"(b)

"Yes definitely. I think the "big4" use more even though there might be exceptions. But in general, I will say yes".

- An auditor with "big4"(b)

"Yes, I definitely think so because it requires huge cost for set up and training. The bigger you are, the more you tend to use ICT".

- An audit executive with "big4"(b)

The above responses show that the huge cost required for audit automation may mean that only the firms with the necessary financial capability will be able to invest and develop the use of ICT on a large scale. This can be traced to the economic reality, efficiency and the size of clients being dealt with. One can draw the conclusion without much hesitation that the size of an organisation determines its audit automation level. This conclusion further strengthens the contingency theory as a potent framework for explaining ICT impact on audits. This is because the contingency theory attempts to explain structural and process differences among organisations with respect to their operating environment, technology, size, strategy and culture (Xiao et al., 1996) rather than making a generalization based on the assumption that every audit firm or department will adopt the same level of automation irrespective of its size.

As a corollary of the above, respondents were asked about the suitability of real time audit review for their audits. A similar trend of response to the above was obtained thus:

"<Real time audit review is> more beneficial to large dispersed organisations than small/medium centralized ones".

- An audit manager with a UK "big7" bank

"It (real time audit review) could be beneficial especially to senior auditors operating on multi-location clients".

- An auditor with "big4"(b)

"A teleconferencing approach makes it easy to get people together especially in a large organisation with dispersed subsidiaries across the country. In my experience, given the nature of the organisation we have here (it is concentrated in a small geographical area) such systems are not needed".

- An audit manager with a city council

It could be gathered from the foregoing arguments that the usefulness of real time audit review is contingent upon the nature of the organisation involved in terms of size, geographical spread and sector of operation. Respondents are of the view that large dispersed and private sector organisations are more likely to benefit from real time audit review than small/medium centralized and public organisations. Also, it could be said that real time audit review is more beneficial to senior auditors than their junior counterparts. Question B21 below generated a WAS of 3.09 out of 5.

		5 Strongly Agree	4 Agree	3 Neither Agree Nor Disagree	2 Disagree	1 Strongly Disagree
B21	The size of my organisation determines the level of automation I utilise for an audit assignment	☐	☐	☐	☐	☐

This result shows no serious level of agreement to or disagreement with the proposition that the size of an organisation determines the level of automation used on an audit assignment. However, the crosstabulation below sheds more light on the discussion.

B30 * A1		A1 Category of Organisation				
		Small Organi-sation	Large Organi-Sation	Other Acctg. Firms	"Big4"	Total
B30 I utilise ..... for my audit assignments	Equal Proportion of ICT and Manual Techniques	1	7	6	3	17
	More Manual Techniques Than ICT Techniques	1	3	2	3	9
	More ICT Techniques Than Manual Techniques	1	15	13	18	47
Total		3	25	21	24	73

Table 4.14: Questions B30 and A1 (Crosstabulation)

Table 4.14 reveals that only 33.3% of respondents (auditors) working with small organisations use more ICT techniques than manual techniques compared to

60.0% of those who work in large establishments. This trend seems to indicate that auditors' use of ICT is contingent on the size of the auditing organisation. This result is strengthened by a Spearman's correlation coefficient of 0.19 which indicates a low but positive correlation (see table 4.14a below). Similarly, 75.0% of auditors working in the "big4" firms use more ICT techniques than manual techniques while only 61.9% of those who work with other accounting firms belong to the same category.

		A1: Category of Organisation	B30: I utilise ..... for my audit assignments
A1: Category of Organisation	Correlation Coefficient	1.000	.191
	Sig. (2-tailed)	.	.109
	N	73	72
B30: I utilise ..... for my audit assignments	Correlation Coefficient	.191	1.000
	Sig. (2-tailed)	.109	.
	N	72	72

Table 4.14a: Questions B30 and A1 (Spearman's rank correlation)

Commenting on whether the size of a particular client affects the level of ICT tools and techniques auditors will use, only two of the interviewees provided a negative response to this question. The rest answered in the affirmative. An example of the former is:

"Not really, the same suite of tools is available to all".

- An institutional response from "big4"(a)

Since small clients are most likely to have a moderate level of computerisation as a high level might be uneconomical, their audit firm might be compelled to step down their level of ICT use for such clients for the sake of systems compatibility as shown in the comments below.

"The area where the client's size might make a difference is data analysis. If the client's ICT system is limited, it might not be compatible with the auditor's system in terms of getting information out of them and vice versa. In addition, the cost efficiency of using sophisticated ICT tools would have to be considered as small clients might not be able to afford it".

- A senior audit manager with "big4"(b)

"Definitely. A lot of our clients have electronic documents, so you can review everything electronically. Therefore, you have to possess the software capabilities to match the client's system. Whereas, for smaller clients, there is a lot of paperwork and as such the audit approach will be different".

- An auditor with "big4"(b)

Conversely, bigger clients would require a higher level of ICT use for speed, accuracy and coverage. According to an audit executive with "big4"(b)

"With large clients, you can't avoid using it. For them you tend to do a control-based audit approach. Then the fact that you are using ICT could mean you are doing less work. Secondly, it gives more coverage of the whole population. So, if it is a bigger client, you will prefer to use that. Then it also comes down to the individuals on the job. If they are familiar with the use of ICT, they will tend to promote it".

The above responses are reinforced by a WAS of 3.50 out of 5 which tends towards agreement on the relevant question in the questionnaire, B20:

		5 Strongly Agree	4 Agree	3 Neither Agree Nor Disagree	2 Disagree	1 Strongly Disagree
B20	My client's size determines the level of automation I utilise for an audit assignment	☐	☐	☐	☐	☐

Furthermore, an attempt can be made to see if the level of auditors' use of ICT tools and techniques is contingent on their organisation type and size as well as auditors' age and class. This is done through crosstabulations of these variables with question B30 as demonstrated below.

B30 * A2		A2 Type of Business				Total
		Acctg. Firm	Manufac-Turing	Service-oriented	Public Sector	
B30 I utilise..... for my audit assignments	Equal Proportion of ICT and Manual Techniques	8	3	2	4	17
	More Manual Techniques Than ICT Techniques	5	0	3	1	9
	More ICT Techniques Than Manual Techniques	29	4	0	14	47
Total		42	7	5	19	73

Table 4.15: Questions B30 and A2 (Crosstabulation)

Table 4.15 indicates that 69.0% of auditors working with accounting firms use more ICT techniques than manual techniques while 73.7% of those who work in public sector organisations belong to the same category. This indicates that auditors' use of ICT is not a function of the type of organisation they work for. This outcome is

reinforced by a Spearman's correlation coefficient of -0.07 which indicates a no correlation (see table 4.15a below).

		A2: Type of Business	B30: I utilise ..... for my audit assignments
A2: Type of Business	Correlation Coefficient	1.000	-.072
	Sig. (2-tailed)	.	.548
	N	73	72
B30: I utilise ..... for my audit assignments	Correlation Coefficient	-.072	1.000
	Sig. (2-tailed)	.548	.
	N	72	72

Table 4.15a: Questions B30 and A2 (Spearman's rank correlation)

Closely related to the result discussed above, table 4.16 below shows that 67.4% and 60.0% of external and internal auditors respectively use a higher proportion of ICT tools and techniques compared to more manual approaches. Again, this result indicates that auditors' use of ICT is independent of auditors' category. The result is further supported by a Spearman's correlation coefficient of -0.11 which indicates a no correlation (see table 4.16a below).

B30 * A3		A3 Class of Auditor		Total
		External Auditors	Internal Auditors	
I utilise ..... for my audit assignments	Equal Proportion of ICT and Manual Techniques	8	9	17
	More Manual Techniques Than ICT Techniques	6	3	9
	More ICT Techniques Than Manual Techniques	29	18	47
Total		43	30	73

Table 4.16: Questions B30 and A3 (Crosstabulation)

		A3: Class of Audit	B30: I utilise ..... for my audit assignments
A3: Class of Audit	Correlation Coefficient	1.000	-.109
	Sig. (2-tailed)	.	.363
	N	73	72
B30: I utilise ..... for my audit assignments	Correlation Coefficient	-.109	1.000
	Sig. (2-tailed)	.363	.
	N	72	72

Table 4.16a: Questions B30 and A3 (Spearman's rank correlation)

This result contradicts Wilson and Sangster's (1992) findings which suggested that because there is a disparity between the domain characteristics of internal auditors (more algorithmic) and external auditors (more judgement-based), the internal auditors do use more ICT tools and techniques.

B30 * A8		A8 Age (in years)					
		18 – 24	25 – 34	35 – 44	45 – 54	55 and above	Total
B30 I utilise for my audit assignments	Equal Proportion of ICT and Manual Techniques	2	10	2	3	0	17
	More Manual Techniques Than ICT Techniques	0	5	3	0	1	9
	More ICT Techniques Than Manual Techniques	5	19	17	6	0	47
Total		7	34	22	9	1	73

Table 4.17: Questions B30 and A8 (Crosstabulation)

Table 4.17 above shows that 71.4% of auditors in age bracket 18-24, 55.9% of auditors in age bracket 25-34, 77.2% of auditors in age bracket 35-44 and 60.6% of auditors in age bracket 45-54 use more ICT techniques than manual techniques in their audits. This shows that there is no link between auditors' increasing age and their level of ICT use. The spearman's correlation coefficient for these two variables as indicated in table 4.17a below is 0.08 and this strengthens the results of the crosstabulations.

		A8: Age	B30: I utilise ..... for my audit assignments
A8: Age	Correlation Coefficient	1.000	.078
	Sig. (2-tailed)	.	.516
	N	73	72
B30: I utilise ..... for my audit assignments	Correlation Coefficient	.078	1.000
	Sig. (2-tailed)	.516	.
	N	72	72

Table 4.17a: Questions B30 and A8 (Spearman's rank correlation)

B30 * A9		A9 Work Experience (in years)					
		1 - 5	6 - 10	11 - 15	16 - 20	21 and above	Total
B30 I utilise ..... . for my audit assignments	Equal Proportion of ICT and Manual Techniques	9	3	1	2	2	17
	More Manual Techniques Than ICT Techniques	2	2	4	0	1	9
	More ICT Techniques Than Manual Techniques	15	7	9	7	9	47
Total		26	12	14	9	12	73

Table 4.18: Questions B30 and A9 (Crosstabulation)

In this final analysis, it is interesting to note that the more experienced auditors also use a higher proportion of ICT tools and techniques compared to manual techniques. This is evident in the fact that 57.7% of auditors with 1 to 5 years audit experience, 58.3% of auditors with 6 to 10 years audit experience, 64.3% of auditors with 11 to 15 years audit experience, 77.8% of auditors with 16 to 20 years audit experience and 75.0% of auditors with more than 20 years audit experience use more ICT than manual techniques in their audit assignments. This shows that auditors' use of ICT techniques is contingent upon their experience. The result is reinforced by a correlation coefficient of 0.16 as indicated in the table below.

		A9: Work Experience	B30: I utilise ..... for my audit assignments
A9: Work Experience	Correlation Coefficient	1.000	.158
	Sig. (2-tailed)	.	.186
	N	73	72
B30: I utilise ..... for my audit assignments	Correlation Coefficient	.158	1.000
	Sig. (2-tailed)	.186	.
	N	72	72

Table 4.18a: Questions B30 and A9 (Spearman's rank correlation)

In a similar vein, questions B24 and B25 from the questionnaire as reproduced below show that auditors tend to use a higher proportion of ICT for complex audit tasks than simple audit tasks (with a WAS of 3.33 and 2.61 out of 5 respectively – see appendix E).

		5 Strongly Agree	4 Agree	3 Neither Agree Nor Disagree	2 Disagree	1 Strongly Disagree
B24	I use more ICT tools and techniques for complex audit tasks than I do for simple audit tasks	☐	☐	☐	☐	☐
B25	I use more ICT tools and techniques for simple audit tasks than I do for complex audit tasks	☐	☐	☐	☐	☐

The results from both qualitative and quantitative data analysed lead us to the conclusion that audit automation is contingent upon the size and type of auditing organisation, client's size and the nature of the audit tasks in question as well as auditors' experience.

This final conclusion further strengthens the potency of contingency theory's application in this area of study. As the theory would disagree with the notion of using specific ICT tools and techniques irrespective of the peculiarity of an audit

assignment, audit client and auditors themselves, the contingency approach takes into consideration realistic relative circumstances of each of these three factors to determine the suitability or otherwise of a particular level of ICT application. We can therefore conclude that the use of ICT tools and techniques for audit tasks is contingent upon and affected by audit firms' and clients' size, nature of audit tasks and auditors' experience.

4.4.0: Conclusion

This chapter has analysed and discussed current trends in the use and implications of ICT tools and techniques by internal and external auditors as underpinned by relevant frameworks. This further enhances our understanding of ICT impact on audit tasks and processes as well as on auditors themselves. The next chapter shows further analysis along the future directions of the ICT–audit relationship.

CHAPTER FIVE

DATA ANALYSIS II:

FUTURE DIRECTIONS OF ICT IMPACT ON AUDITING

5.0: Introduction

In furtherance of the foregoing analysis contained in the last chapter, this chapter focuses on the aspects of the analysis that have to do with the likely future directions and the possible impact of ICT on auditing. As in the last chapter, conversational analysis is adopted for analysing qualitative data while univariate analysis (frequency tables) and bivariate analysis (crosstabulations) are used for the quantitative data.

5.1.0: Proposition IV: ICT Does Have Potential Ways of Impacting on Auditing

In spite of the benefits ICT has brought into auditing as shown by the first proposition in the last chapter, it is believed that the upward trend of ICT usage could still provide better forms of advantages and enhancement to the audit profession. This proposition sets out to identify the potential improvement in audit as an anticipation of the future ICT-auditing relationship thereby charting a new course for designers of audit packages, DSS and KBES, and making a contribution to knowledge.

The interview responses on the potential areas for ICT use in audit provide the best form of responses useful for this proposition. These responses indicate that continuous improvement in all areas of audit to meet clients' ever increasing expectations is needed in order to meet the ever-changing business technological environments.

"Pressure to change ICT tools and techniques constantly as a result of the dynamism in business information systems coupled with the usual resistance to change from staff members".

- An institutional response from "big4"(a)

"I think all the areas of audit can benefit further from ICT. As systems themselves become more ICT dependent and ICT becomes more and more sophisticated and advanced, audit has to keep pace and keep up with the advancements. So, all areas of audit could always benefit from further utilization of ICT".

- An audit manager with a city council

These comments reveal that ICT use in audit can be client-driven I.e. it becomes professionally imperative to use ICT for audit firms to remain in practice. Furthermore, it could be worthy of note that this comment is from one of the two "big4" audit firms that participated in the interview. This fact indicates that there is a wave of competition in the auditors' adoption of ICT tools and techniques in their audit engagements. In other words, they use ICT to create competitive advantage and to prove to their clients that they can do what their rivals do if not better. This is succinctly phrased by the institutional response from "big4"(a):

"Meeting clients' expectation is part of it. They use technology, so should we".

This conclusion corroborates Manson et al.'s (2001: 1) finding that

> *"audit automation cannot be viewed simply as a technology for improving the quality/or productivity of the audit process. It also has value as a symbol of the firm's market competitiveness and hence helps to promote the firm both to clients and internally".*

The responses above from both internal and external auditors indicate that continuous improvement of the current computer-based audit tools and techniques is necessary. This might be as a result of the dynamism of ICT itself or increased efforts towards perfecting audit tasks to the satisfaction of shareholders' needs as well as the needs of other users of audited corporate financial statements.

In addition, some interviewees identified the area of gaining a better understanding of clients' business and industrial base as a potential area where ICT could benefit auditing:

"Using more artificial intelligence in gaining industry knowledge".

- An institutional response from "big4"(a)

"The area of the planning process could be made more efficient by getting things like new technology to catch the industry knowledge. Technology such as the 'process models' could be readily available and customised so that the auditor will only need to do the manning [staffing]..... needs of the clients".

- A senior manager with "big4"(b)

From the two comments above, it is apparent that auditors, particularly external auditors working with the "big4", would welcome more sophisticated technology tools such as artificial intelligence and process models to gain a better insight into the operational details of their clients and the industry within which they function. This kind of broad-based knowledge and understanding is crucial at the early stage of audit assignments as it helps auditors through the subsequent levels and stages and the subsequent audit opinion.

Although Control Objective for Information and Related Technology (CobiT) framework has been available for quite a while, the responses below show that some auditors are quite unaware of it and are clamouring for what the framework

already covers. This shows that the framework is not yet as popular as one would expect.

"In large organisations with integrated systems, ICT could help in supporting the integration of an organisation-wide activity by integrating risk and control with business objectives".

- An audit manager with a "big7" bank

"The main areas that could also benefit further will be checking and validation of major corporate systems and the control of such systems, IT audit, corporate assurance and corporate governance".

- An audit manager with a city council

Also, it is interesting to note that all the respondents quoted above are senior auditors at manager level in their respective establishments (industry and practice; private and public sector). The main points of their advocacy can be summarised in CobiT which is currently in its third edition and being championed by the Information Systems Audit and Control Association (ISACA, 2005). The CobiT approach provides answers to some of the problems identified in the quotes as it extends COSO's fiduciary role as an internal control framework to cover the aspects of quality and security as key control objectives in order to take care of IT controls.

As previously shown in the first proposition of the last chapter on ICT and audit effectiveness, data transfer from clients' systems to those of auditors is a major cause for concern to auditors. Little wonder then that auditors identify this as a potential way in which ICT could benefit themselves further. That is, ICT should solve the problem it has created in the first instance.

"There is an element of benefit derivable from having our systems linked to our clients' systems. This will make our analysis easier and more straightforward".

- An auditor with "big4"(b)

"In theory, it will be nice to have a tool that we could use to automatically download clients' work into our systems. Also, if there could be ICT techniques that could enable us to have a direct link to our office-base and download straight from there as well".

- An assistant audit manager with a city council

In a similar vein, one of the open ended questions, B33 evaluates this area of the research:

B33. The following are the **potential** ways in which ICT can benefit the audit process:.....

The responses identify a wider application, adoption and enhancement of existing tools and techniques. The following is the list of the most frequent responses to question B33 in order of respondents' prioritisation:

i. Remote auditing (enterprise wide testing from one location)
ii. Increased availability of artificial intelligence systems for risk assessment
iii. Packages to interrogate the client's system
iv. Continuous improvement of the existing packages via research
v. Online auditing and control facilities

Combining the responses from the open ended question with those from the interview, the areas of potential ICT use can be classified into two, those that are already provided for but require a wider use and those that are genuinely lacking. The former includes COA, artificial intelligence, remote auditing and COBIT while the latter comprises the ease of linkage with clients' IS to avoid problems

associated with downloading clients' data, packages to gain a better understanding of the clients' business and industry and continuous improvement on the current state of ICT tools and techniques to meet both client-driven and ICT-driven forms of change. It is noteworthy that none of the previous studies reviewed earlier in the second chapter probed into areas of audit with a futuristic scope in terms of the potential use of ICT. The discussion above shows that ICT does have potential ways of impacting on auditing.

5.2.0: Proposition V: Audit Automation Affects the Structure of an Organisation

This proposition is aimed at examining the effects of audit automation on three important areas of auditing and audit organisations (firms and departments). These are human resource practices such as recruitment and promotion, structures of audit tasks and audit organisations and power shift. The conclusions on this proposition are expected to justify or deny the applicability of the structuration theory to the understanding of ICT's impact on audit and the audit process.

Two aspects of the human resource practices covered by the interviewees' responses are recruitment and promotion. Some of the respondents believe that although ICT skill might tangentially be useful at the recruitment level, it is not a necessary quality when employing fresh graduates.

"ICT skill is not much emphasized at <the> recruitment level as long as the employees are intelligent enough. They should be able to cope with our ICT use once they join. Their initial training in ICT at the university might not be related to our packages but given their level of basic skills, they should be adaptable to our ICT tools and techniques".

- An audit manager with a UK "big7" bank

However, ICT skills can serve a useful purpose if candidates are required to file their applications online as is evident in the quote below from an auditor with "big4"(b).

"In terms of recruitment, a lot of the applications are done and reviewed online. The more ICT proficient candidate might have an edge over others".

Similarly, interview candidates might be required to use ICT tools in making presentations and/or asked questions bordering on the use of ICT for audit tasks as shown in the comment below.

"Not quite an important factor in the area of recruitment but candidates might be required to make a presentation using PowerPoint. They might also be asked some ICT related questions".

- An audit manager with a city council

From the comments above, it can be observed that ICT skills stand as only one of the numerous requirements that will be considered when recruiting an auditor. It is assumed that a graduate with the requisite intelligence should be able to adapt to the technological environments obtaining in today's audit profession. This finding tallies with that obtained from the frequency table on question C22 from the questionnaire:

		5 Strongly Agree	4 Agree	3 Neither Agree Nor Disagree	2 Disagree	1 Strongly Disagree
C22	The consideration of an employee's ICT skills constitutes a major criterion for recruiting new auditors in my firm/department	☐	☐	☐	☐	☐

This question generated a WAS of 3.42 out of 5 which indicates that the majority of respondents tended towards neutrality on this subject. Similarly, Manson et al.'s (1997) research found that audit firms had not changed their recruitment policies despite making more extensive use of ICT. However, the interview excerpts above show that ICT might be a determining factor where one of two candidates with similar knowledge and skill levels in other areas stands out in their ICT abilities.

Contrary to the interview responses obtained on the role being played by ICT in the recruitment of auditors, interviewees believe that ICT would be a necessary factor in auditors' promotion either directly or indirectly as depicted by the following two comments:

"In terms of promotion, ICT would certainly be a factor as part of what makes a good audit is a reasonable use of ICT tools and techniques. For you to get promoted, you need at least a base line knowledge and skill in all the key areas of audit including ICT. A level of expertise comparable to others".

- A senior manager with "big4"(b)

"As regards promotion, possibly because if you manage to become a learning champion in a certain area of ICT, people are always coming to ask you questions, you are certainly going to get recognition in the firm. In that respect, your profile would be boosted which obviously will then go on to promotion enhancement".

- An auditor with "big4"(b)

Furthermore, it is anticipated that the consideration of ICT skills in promoting auditors would be made official by audit organisations as shown below by an audit executive with "big4"(b)

"I reckon ICT might play a major part in staff promotion in the near future even though that is not yet happening at the moment as there are some senior managers now that don't have much ICT skill".

These responses indicate that ICT would be a strong factor in the career progression of an auditor as it makes auditors that are proficient in its usage more easily recognised and accorded respect within the firm or department. This result is reinforced by a WAS of 3.86 out of 5 (indicating agreement) generated by question C19:

		5 Strongly Agree	4 Agree	3 Neither Agree Nor Disagree	2 Disagree	1 Strongly Disagree
C19	The increasing adoption of ICT in the audit process has aided my professional career development	☐	☐	☐	☐	☐

We can therefore observe that audit automation is currently perceived to have a small indirect impact on the recruitment of new auditors but a fairly significant impact on auditors' promotion. This finding shows that as a result of the emphasis currently being placed on ICT skills for auditors' promotion in the very near future, this trend will extend to recruitment and such skills will form one of the bases in the selection process for auditors.

In addition, the results of the frequency tables on the question regarding whether the increase in audit automation has led to a high labour turnover in audit firms/departments (C23) produced a WAS of 2.56 out of 5. This indicates a response pattern that hangs between very mild disagreement and neutrality showing there is no high labour turnover arising from ICT implementation.

The question on audit automation creating a number of job opportunities for specialist auditors (C21) produced a stronger WAS of 3.75 which implies a

response that tends towards agreement while a WAS of 3.13 out of 5 was obtained from the question on whether these tools and techniques have had an effect on the number of professional staff in audit firms/departments (C36) (see appendix E). These results indicate that ICT implementation in the audit process tends to reduce the levels of administrative staff but is likely to increase the number of professional staff.

The foregoing analyses therefore show that the more computerised an organisation is, the higher the number of its professional and specialist staff. Also, it reveals that the more computerised an organisation is the lower the number of its administrative and junior audit staff. That is, the more computerised an organisation is the lower the number of its non-professional and junior staff becomes while its senior professional staff numbers tend to increase. This finding partially differs from that of Bagnall's (1991) study which put forward the idea that the more automated an organisation becomes the smaller the number of both its clerical and professional staff becomes. While it agrees with Bagnall on the reduction in the number of clerical staff, it shows that the number of professional staff increases rather than decreases as put forward by Bagnall.

However, the finding, to a large extent, tallies with that of Banker et al. (2002) which put forward the idea that automation and the use of specialised audit software has substituted ICT for labour and that of Manson et al.'s (1997) study which suggested that deskilling as a consequence of ICT did not apply to accounting firms as professional staff were having to concentrate more on 'higher level' tasks. The main difference between this study's finding and those of the last two is that Banker et al. (2002) did not distinguish between professional and clerical/administrative labour in its assertion while Manson et al. (1997) only concentrated on professional staff. The finding totally agrees with the work of Wilson and Sangster (1992) which suggested that the effect of ICT on accounting

has been to increase the overall level of professional employment but marginally decrease the overall level of clerical employment.

The third main area intended to be examined on this proposition as stated earlier is the impact audit automation might have on the structures of audit firms/departments. A sizeable number of the interviewees discussed this issue with enthusiasm. The Internet has made feasible online interactions, processes and procedures such as real time audit review. This, according to the institutional response from "big4"(a):

"Potentially allows for a more disaggregated leadership structure (i.e. the leadership team does not all need to be in the same place to have an interactive meeting)".

The same point is made by a senior manager with "big4"(b) who looked at these online capabilities from the perspective of head office-regional office task structures as shown below.

"It probably helps the operations of the office. It is easier to have a regional back office function in terms of the review of time sheets and work-in-progress. Invariably, ICT has allowed more operations to be carried out at the regional level".

In addition, as shown in earlier analysis, the use of ICT tools and techniques and its attendant effect of increasing the number of specialist auditors and other professionals has made it compelling for most firms and corporate audit departments to restructure their strategic business units (in the forms of departments, sections, units or groups) as well as their responsibilities. Auditors working in each unit are therefore expected to be familiar and proficient in the use of ICT tools and techniques relevant and peculiar to their units. This is supported by the following two comments.

"…. if certain experts are using a set of tools and techniques, this might lead to segregation of duties which would invariably mean they would be grouped together into the same unit. Such a unit would be responsible for works requiring the skills and expertise of such expert auditors. This, therefore, has slightly changed the structure in terms of the assignment of operational responsibilities. However, this hasn't made much difference in terms of hierarchy and the structure of reporting lines".

- The chief auditor of a UK "big7" bank

"In terms of structure, it has not particularly been affected by ICT except that we have a specialist IT audit team within the audit department and this team has an equal status with other audit teams".

- An audit manager with a city council

The trend depicted by the last finding that the number of non-professional and administrative staff declines as audit automation increases is likely to make the bottom part of audit organisations' structures thinner than it used to be as there will be more employees in the middle level (comprising professionals) of the structure compared to the top (comprising management) and the bottom (comprising non-professional staff).

"Although it doesn't make a huge difference, to some extent it has led to a flattening of the structure. So, we've got less need for staff especially the junior staff who are involved in substantive detailed work for managers to just review. In the pre automation days, I used to work with eight junior auditors but now with just one and I can say our performance has been boosted by ICT rather than diminished".

- An audit manager with a UK "big7" bank

It can be observed from the excerpted quotations above that audit automation could lead to a disaggregated leadership structure, decentralisation of role and responsibilities and restructuring to cater for specialised auditors such as IT auditors. Also, audit automation is said to have flattened the organisation structure of most audit firms and departments as ICT has taken over the mechanical and routine roles of most junior auditors in a more efficient and effective way. Similarly, question C33 below produced a WAS of 3.98 out of 5 which shows that audit automation strengthens the internal control systems of audit organisations.

C33. The use of ICT tools and techniques ..... the internal control systems of my organisation/my audit clients.

5	4	3	2	1
Greatly Strengthens	Strengthens	Neither Strengthens Nor Weakens	Weakens	Greatly Weakens
☐	☐	☐	☐	☐

The foregoing discussion strengthens the applicability of Gidden's structuration theory to the study of ICT impact on auditors and the organisations they work for as earlier advocated by Manson et al. (2001) and Caglio (2003). The former combined the structuration theory with Coombs et al.'s (1992) theoretical framework of culture, control and competition to expound audit automation as controls within audit firms while the latter used structuration theory solely to underpin his study on how ERP is changing the roles of the 21st century accountant.

With ICT as the agent employed for the purpose of delivering good audit performance, the structuration process as put forward by Giddens ensues as a result of the agent leading to the restructuring of audit tasks and audit organisations.

Interviewees are divided on the last area of focus under this proposition, the implication of audit automation on power and authority within audit firms and

departments. Question C9 below produced a WAS of 2.90 out of 5 which actually tends towards neither agree nor disagree.

		5 Strongly Agree	4 Agree	3 Neither Agree Nor Disagree	2 Disagree	1 Strongly Disagree
C9	The implementation of ICT has led to power shift (political) within my firm/department	☐	☐	☐	☐	☐

Similarly, a cross section of the participants in the interview believe that ICT does not play any role in this regard because their organisations' set up has remained the same with or without an increase in the level of automation. This shade of opinion is depicted in the following quotes from the interview sessions conducted:

"In terms of power shift, chain of command and authority, no, but all things being equal, some would have an edge as a result of their technical capabilities".

- An audit manager with a UK "big7" bank

"I don't see ICT playing any role in empowering or disempowering as long as the right people are doing the right task with the right responsibility. However, ICT could threaten power and authority but it has to be carefully brought through so that it doesn't have a negative impact. Here, we do have an IT audit section. By the nature of their work, they do form a power-base and other people I spoke to could sense that".

- An assistant audit manager with a city council

"There is nothing like powershift as a result of ICT. Everyone has got a standard knowledge of ICT. We do have champions in each department who are like problem shooters wherever the need arises. These people are accorded more respect though not real powers".

- An auditor with "big4"(b)

"No significant change, greater emphasis has been placed on knowledge management and the use of technology on audits, but the chain of command has not changed significantly".

- An institutional response from "big4"(a)

It can be observed that even though the commentators above begin their statements with the notion that ICT has not had any impact on power and authority, they end up acknowledging that it could have had an impact, therefore more-or-less supporting the views of the interviewees that believe ICT has led to powershift within their organisations as shown below:

"It has sort of shifted power to ICT experts because we have to ask them for much. We rely on them a lot because we don't know much. Recently, IT has been put under the Director of Finance which makes him more powerful".

- The head of internal audit of a housing association

"There has been a little change. The higher up a person is in the chain, the less ICT techniques he/she will use. In that sense, there has been a shift of knowledge towards the people considered a bit lower in the organisation and as such, they wield more influence".

- An auditor with "big4"(b)

"All other things being equal, ICT might give more power to auditors who are more proficient in it above their colleagues who are not".

- An IS manager with a UK "big7" bank

"Not very noticeable but I guess being proficient in the use of ICT would make an auditor understand the performance of a business better, makes him do a better job, in terms of knowing whether or not the client is selling well, doing well, identify where they are doing well etc. Overall, ICT's effect on power and authority would depend more on the individual managers rather than a particular regional office or section".

- A senior manager with "big4"(b)

The two classes of comments above add credibility to the idea that ICT enhances the profile of auditors that are more proficient in its use. It accords them special recognition and hence gives them an advantage when it comes to power play and influence within their departments or firms. Even though some of the commentators did not want to acknowledge this straightaway, their countenances as well as concluding remarks indicate that even if they never realised it before the interview, they did acknowledge it is a reality no matter how low they might estimate such effects.

The crosstabulation below attempts to investigate whether or not there is any relationship between auditors' views on ICT impact on powershift and auditors' experience.

C9 * A9		A9 Work Experience (in years)					Total
		1 - 5	6 - 10	11 - 15	16 - 20	21 and above	
C9 ICT has led to political power shift within my organisation/ department	Strongly Disagree	0	1	2	1	0	4
	Disagree	5	2	7	1	3	18
	Neither Agree Nor Disagree	16	5	4	3	6	34
	Agree	4	3	1	2	1	11
	Strongly Agree	1	1	1	1	0	4
Total		26	12	15	8	10	71

Table 5.1: Questions C9 and A9 (Crosstabulation)

Since most of the respondents tend towards a neutral or disagreement opinion on this subject, it will be wise to focus our analysis on those who agree that ICT leads to powershift to assess the relationship. The five experience categories shown in the table above generate results in agreement of 19.2% (1-5 years), 33.3% (6-10 years), 13.3% (11-15 years), 37.5% (16-20 years) and 10.0% (21 years and above). This indicates that there is no relationship between the two variables. This result is reinforced by a correlation coefficient of -0.12.

		A9: Work Experience	C9: ICT has led to political power shift within my organisation/department
A9: Work Experience	Correlation Coefficient	1.000	-.120
	Sig. (2-tailed)	.	.322
	N	73	70
C9: ICT has led to political power shift within my organisation/department	Correlation Coefficient	-.120	1.000
	Sig. (2-tailed)	.322	.
	N	70	70

Table 5.1a: Questions C9 and A9 (Spearman's rank correlation)

Also, despite the variety of opinion there is no strong view on this idea either way though 22 out of 71 disagree with the proposition while only 15 out of 71 agree, so the balance might be thought to lie more with the dissenters.

Also, we can further scrutinise responses obtained from questions earlier discussed in this proposition to see if the responses of internal auditors agree with those of external auditors as shown in tables F36 to F43 of appendix F. Considering the number of respondents in agreement or strong agreement with the propositions presented, these crosstabulations are summarised in the table below for ease of drawing conclusions.

	External auditors	Internal auditors	Inference
ICT has led to changes in organisation structures	61.0%	60.7%	No Association
ICT has led to political powershift within my firm/department	21.4%	21.4%	No Association
ICT aids auditors' career development	81.0%	88.9%	No Association
ICT has created more jobs for specialist auditors	73.8%	53.6%	No Association
ICT has increased labour turnover	17.1%	13.8%	No Association
ICT has increased the number of administrative staff	9.5%	4.2%	No Association
ICT has increased the number of professional staff	30.0%	16.0%	No Association
ICT strengthens internal control system	85.4%	84.0%	No Association

Table 5.2: Class of Auditors and Audit Organisations

Table 5.2 above shows that there is no relationship between auditors' class and the effect audit automation might have on changes in organisation structure, political powershift, enhancement of auditors' career development and strengthening of the internal control system, jobs creation for specialist auditors and increase in staff numbers.

In concluding this proposition, we can safely conclude from the foregoing arguments that the increasing wave of audit automation is having an effect on the organisation structure, task structure and responsibility allocation in the audit

profession. As stated earlier, this conclusion partially supports that of Bagnall (1991) and fully supports that of Manson et al. (1997). It is also in perfect harmony with Banker et al. (2002:210) which stated that:

> *"Automation and use of specialised audit software has substituted IT for labour and changed the structure of audit teams".*

This sort of conclusion is best underpinned by Giddens' structuration theory as similarly applied by Manson et al. (2001). Giddens' (1984) theory proposed three properties of a social system: structure, modality and interaction. These three properties are said to be the essential media and outcomes of one another in an organisational setting. Giddens postulated the duality of structure as a process through which structures enable or constrain human actions which are thereafter constructed or reconstructed by that very action. This process is said to be based on structure (organisation and task forms), modality (audit process) and interaction (human and ICT).

This study's findings indicate that the wide adoption of ICT tools and techniques in audit has, in the first instance, tended to reduce the number of non-professional (administrative) staff and junior auditors in audit firms/departments. In line with Giddens' theory, ICT has in turn influenced the restructuring of these firms/departments as a result of technology-driven change in auditors' operational techniques as well as the increasing number of specialist auditors.

The above conclusion implies that the number of senior level auditors might reduce within the nearest future as it is expected that it is the currently reduced junior level auditors that should ascend into senior positions later in their career path.
Based on the findings on the impacts of audit automation on audit firms/departments structures, recruitment and promotion as well as power and authority among auditors, it would be correct to state that audit automation does

affect the structure of an audit organisation and therefore affirm that audit automation does affect the structure of an audit organisation.

5.3.0: Proposition VI: COA Could Be Considered the Future of Auditing

As discussed earlier in chapter two, COA is an emerging auditing technique that could bring about a great deal of ease and effectiveness to the modern audit particularly with the increase in the use of online real-time mechanisms for business transactions. This proposition is therefore constructed to assess the current and future relevance of COA for the use of both internal and external auditors.

The relevant open ended question, D10, on the possible ways in which COA could enhance audit effectiveness was answered by 45 respondents (60.8% of the total respondents). The following is the list of the responses to question D10 in order of respondents' prioritisation:

i. Quick discovery and investigation of errors and fraud
ii. Reduction of post year end intensive work level
iii. Time saving
iv. Adequacy, sufficiency and reliability of audit evidence
v. Timely feedback to clients and other users
vi. Assurance of data accuracy
vii. Instant capture of transactions and control breaches
viii. Makes review easier

The list above indicates that the most important area at the forefront of auditors' minds is COA's ability quickly to discover and investigate errors and fraud. As these two phenomena constitute a potential internal control problem which both internal and external auditors are always watching out for in their audit

responsibilities, COA will, without any doubt, make their task easier to carry out and reduce both audit control and detection risks.

Similarly, although a number of areas were identified by interviewees as possible ways through which COA could enhance audit effectiveness, quick discovery of errors and fraud does stand out. The excerpts from the interviews below indicate that COA could generate high powered instantaneous analysis of raw data which makes it possible to highlight problems early and to communicate the problems identified (e.g. internal controls deficiency) to the management for prompt action.

"Yes, in both areas it gives the auditor a greater opportunity to analyse core information in its raw state when it is actually produced, rather than after the event. This gives the auditor a greater opportunity to spot problems as they happen, reducing the problems that the auditor and the client may have in the future. Besides, it ensures greater precision in testing".

- An institutional response from "big4"(a)

".....Through continuous monitoring, you can see a problem more quickly and you can stop it before it gets too far rather than coming at the end of the year. This could reduce audit risk".

- An auditor with "big4"(b)

Furthermore, responses to question D10 as summarised in the table above show that COA's ability to scrutinise transactions and accounting procedures as they occur through its continuous validation techniques reduces the usual intensive efforts required of auditors at the financial year end, ensures accuracy of data and exposes control breaches. In addition, COA's reporting style (which could be instantaneous or on demand) ensures a timely feedback to clients and other users of financial reports with respect to well-timed assurance. Therefore, COA could

further strengthen users' confidence in the depth of auditors' work and the reports that are generated from their work as depicted in the following comment:

"COA would help to address some of the concerns the public have about the depth of the work carried out by auditors and the rigour of their work and it should reduce year end work and the usual pressure on teams at year-end"

- An institutional response from "big4"(a)

Added to these advantages, interviewees are somewhat divided on the issue of who benefits more from the use of COA between internal and external auditors. Interestingly, a majority of the external auditors who commented on this issue think COA could be more beneficial to internal auditors because they are expected to be monitoring various internal control systems constantly throughout the financial year. Also, they believe COA will be less useful for the external auditors as COA might take up a lot of their own and the client's time to discuss the impact of issues on areas requiring judgement rather than compliance.

"From the internal audit perspective, it can change the focus of what the auditors do if they can get the required information on a more timely basis. However, from the external audit perspective, I'm less convinced there is much to achieve".

- A senior manager with "big4"(b)

"Yes for internal auditors because they require continuous auditing throughout the year. In terms of external audit, it is limited in use because, quite often, you need to speak with the clients especially when the issue affects audit judgements that require clients' explanations and views. But in terms of monitoring, yes".

- An auditor with "big4"(b)

However, some of the interviewees hold the view that COA is just as useful to the external auditor as it is to the internal auditor as a core aspect of the external

auditor's work is risk and internal control assessments which most interviewees (internal or external auditors) believe COA strengthens. Moreover, the provision of SAS 500 (Considering the Work of Internal Audit) which permits and sets out the main criteria for external auditors to place reliance on internal auditors' work makes COA a relevant tool for both parties as their work quite often overlaps. This view is stressed in the following interview comment which also advocates that COA could possibly link together both internal and external audit processes to enhance overall control and assurance purposes.

"I think it will be nice to have the internal and external audit process integrated through COA where they can work hand in hand. However, this might be compromising auditor independence".

- An assistant audit manager with a city council

The point of view expressed above confirms the assertion of Alles et al. (2002) which stated that the more comprehensive COA becomes the closer the relationship between the auditor and the auditee and this tendency might threaten auditor independence.

In spite of COA's benefits enumerated above, respondents were able to identify the following as possible weaknesses of COA in response to question D11:

D11. The following are the possible ways COA could jeopardise audit effectiveness:

i. Overreliance on COA at the expense of other assessment
ii. Might take away the element of judgement
iii. Down time or system bug
iv. May be too intrusive/clients' employees might be uncomfortable
v. Might increase fraud if clients know the system
vi. Incorrect set up
vii. Reduces human contact
viii. Audit report might lose importance and effectiveness
ix. Might limit analyses and comparisons

Similarly, some of the interviewees discussed potential weaknesses inherent in the adoption and use of this auditing technique. Some of their comments show that the readiness of audit professionals and their clients to adopt COA is still an issue requiring careful attention. Firstly, interviewees were concerned about the readiness of the profession from an educational point of view:

"There is an inadequate awareness of the process by most auditors. There are perception issues around what would be done and we are uncertain as to how well prepared from a training point of view the profession is for the transition. In addition, there is the problem of readiness of the clients".

- An institutional response from "big4"(a)

The second concern identified related to worries about over-reliance on the simple findings produced by COA when the auditor should have a wider and less restricted view of the evidence in front of them:

"Yes, limitations in terms of perception that the statistics might suffice for the auditor rather than the quality of information depending on the nature of what is being audited. There are certain things you can't purely automate".

- An IS audit manager with a "big7" bank

Finally, the inevitable expense and security implications would have to be considered:

"Cost to the clients who are always looking at it from a cost-benefit perspective. These costs include setting up cost, cost of training etc. Again, there is the danger of hacking into the systems and back-up requirements".

- An auditor with "big4"(b)

Also, there is that fear that COA might lack the flexibility of approach auditing always requires but rather tempt the auditor to be overreliant on automated procedures, whereas these procedures might not be able to detect actions relating to connivance.

"Auditors may become over-reliant on automated procedures to pick up errors and you may ignore other factors e.g. collusion to defraud".

- An institutional response from "big4"(a)

These findings were equally stressed by the Institute of Internal Auditors Research Foundation's (2003) view that although internal auditors are interested in COA, they lack the required training and skill to implement it and the huge costs involved remained the main limiting factor.

On the other hand, all the limitations discussed in the interview excerpts above are considered with suggestions for ways round the difficulties. These comments show that the limitations earlier identified could be overcome through adequate awareness campaigns on the workings and benefits of COA. These awareness

campaigns might be carried out by the professional bodies through the CCAB, by way of feature articles in their monthly journals/magazines, articles on success stories of COA, symposia, workshops and conferences.

"There is a need to generate awareness of how the process works, briefings for auditors and companies on the process and the impact it will have on their practice, getting some high profile successes and making the community aware of the benefits".

- An institutional response from "big4"(a)

Also, audit regulatory authorities could be of help by issuing appropriate standards and guidance to make the practice of COA clear and unambiguous with regards to who does what and who takes what responsibility among the parties within the field of corporate governance.

"Keeping the clients informed, giving them information on the system and establishing normal protection and care to prevent hacking".

- An auditor with "big4"(b)

In addition, these problems could be overcome effectively by introducing COA while its degree of reliability remains intact, introducing management accounting controls and strengthening systems protection and care to prevent hacking.

"It would be useful if a degree of flexibility can be introduced to the system without compromising its integrity. For example, frequency of review being varied depending on the manager's decision on the appropriateness of such reviews".

- The chief auditor of a UK "big7" bank

Furthermore, questions D1 to D9 in the questionnaires probed into the usefulness of COA in fraud prevention, detection and investigation as well as its decision usefulness to all the stakeholders.

		5 Strongly Agree	4 Disagree	3 Neither Agree Nor Disagree	2 Disagree	1 Strongly Disagree	WAS
D1	COA could help me in fraud prevention	5 (8.6%)	34 (58.6%)	15 (25.9%)	4 (6.9%)	0 (0%)	214/58 = 3.69
D2	COA could help me in fraud detection	6 (10.3%)	40 (69.0%)	11 (19.0%)	1 (1.7%)	0 (0%)	225/58 = 3.88
D3	COA could help me in fraud investigation	7 (12.1%)	37 (63.8%)	13 (22.4%)	1 (1.7%)	0 (0%)	224/58 = 3.86
D4	COA could enhance the decision usefulness of financial information to the shareholders/partners in my organisation	9 (15.5%)	27 (46.5%)	19 (32.2%)	3 (5.2%)	0 (0%)	216/58 = 3.72
D5	COA could enhance the decision usefulness of financial information to the investment analysts	5 (9.1%)	23 (41.8%)	24 (43.6%)	3 (5.5%)	0 (0%)	195/55 = 3.55
D6	COA could enhance the decision usefulness of financial information to prospective investors	5 9.4(%)	21 (39.6%)	24 (45.3%)	3 (5.7%)	0 (0%)	187/53 = 3.53
D7	COA could enhance the decision usefulness of financial information to the tax authorities	5 (8.9%)	26 (46.4%)	22 (39.3%)	3 (5.4%)	0 (0%)	201/56 = 3.59
D8	COA could enhance the decision usefulness of financial information to the employees of my organisation	3 (5.4%)	25 (45.5%)	23 (41.8%)	4 (7.3%)	0 (0%)	192/55 = 3.49
D9	COA could enhance the decision usefulness of financial information to the general public	3 (5.3%)	27 (47.4%)	24 (42.0%)	3 (5.3%)	0 (0%)	201/57 = 3.53

Responses to all these nine questions (D1 to D9) generated a WAS of between 3.49 and 3.88 each (see appendix E). This indicates that respondents, irrespective of whether they are internal or external auditors, tend to agree that COA could be

of value to both auditors and their clients as well as to the general public in terms of its investigation powers and the usefulness of the financial information provided.

In addition, an attempt could be made to see if there is any link between respondents' level of ICT utilisation and their opinion on the usefulness and relevance of the COA technique through the use of crosstabulations. The two questions selected for the crosstabulations are D4 and D9.

The reason for selecting these two questions is because the shareholders are the primary addressee of the auditor's report while any member of the general public might be considered to be another form of stakeholder. Also, since the nine questions (D1 to D9) generated similar WAS (between 3.49 and 3.88 according to appendix E), they are likely to yield the same result when crosstabulated with the same variable. These two questions are crosstabulated with question B30 on respondents' level of ICT utilisation compared with manual techniques.

It is expected that the level of a respondent's ICT utilisation might influence his/her appreciation of COA's benefits more fully. Also, out of these nine questions the two above are considered most appropriate as the main addressees of an audit report are the shareholders and other stakeholders represented by the public.

B30 *D4		D4 COA could enhance the decision usefulness of financial information to the partners/shareholders				
		Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree	Total
B30 I utilise ..... for my audit assignments	Equal Proportion of ICT and Manual Techniques	0	4	4	3	11
	More Manual Techniques Than ICT Techniques	1	2	4	2	9
	More ICT Techniques Than Manual Techniques	2	12	20	4	38
Total		3	18	28	9	58

Table 5.3: Questions B30 and D4 (Crosstabulation)

Of the 38 auditors who use more ICT techniques than manual techniques in their audit, 24 (63.2%) also believe that COA could enhance the decision usefulness of financial information to the partners/shareholders while only 12 (31.6%) believe COA would have no effect in enhancing the decision usefulness of financial information to the partners/shareholders. 7 out of 11 (63.6%) and 6 out of 9 (66.7%) of the other two categories believe the same. This result indicates auditors' perception on the usefulness of COA is not a function of their level of ICT usage in their audit tasks. The correlation coefficient of -0.09 shown in the table below supports this conclusion.

		D4: COA could enhance the decision usefulness of financial information to the partners/shareholders	B30: I utilise ..... for my audit assignments
D4: COA could enhance the decision usefulness of financial information to the partners/shareholders	Correlation Coefficient	1.000	-.093
	Sig. (2-tailed)	.	.489
	N	58	57
B30: I utilise ..... for my audit assignments	Correlation Coefficient	-.093	1.000
	Sig. (2-tailed)	.489	.
	N	57	72

Table 5.3a: Questions B30 and D4 (Spearman's rank correlation)

From table 5.4 below, of the 38 auditors who use more ICT techniques than manual techniques in their audit, 21 (55.3%) also believe that COA could enhance the decision usefulness of financial information to the general public. 4 out of 9 (44.4%) and 6 out of 10 (60%) of the other two categories believe the same, while only 15 (39.5%) believe COA would have no effect in enhancing the decision usefulness of financial information to the general public. Again, we can conclude that COA is decision useful to the general public, although the perception of its usefulness to this user group is lower than its perceived usefulness to shareholders and partners. Again, this result indicates auditors' perception on the usefulness of COA does not have a direct relationship with their level of ICT usage in their audit tasks. This result is further strengthened by a correlation coefficient of 0.01 as shown in table 5.4a.

B30 *D9		D9 COA could enhance the decision usefulness of financial information to the general public				
		Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree	Total
B30 I utilise ..... for my audit assignments	Equal Proportion of ICT and Manual Techniques	0	4	5	1	10
	More Manual Techniques Than ICT Techniques	1	4	4	0	9
	More ICT Techniques Than Manual Techniques	2	15	19	2	38
Total		3	23	28	3	57

Table 5.4: Questions B30 and D9 (Crosstabulation)

		D9: COA could enhance the decision usefulness of financial information to the general public	B30: I utilise ..... for my audit assignments
D9: COA could enhance the decision usefulness of financial information to the general public	Correlation Coefficient	1.000	.009
	Sig. (2-tailed)	.	.948
	N	57	56
B30: I utilise ..... for my audit assignments	Correlation Coefficient	.009	1.000
	Sig. (2-tailed)	.948	.
	N	56	72

Table 5.4a: Questions B30 and D9 (Spearman's rank correlation)

Interestingly, this is the first empirical research on the relevance and significance of COA to both internal and external auditors. As such, the result can only be compared with the theoretical advocates obtained from previous studies. It tallies with Rezaee et al.'s (2001) forecast that COA would soon become irresistible to auditors with the current exponential growth in technological capabilities as well as Higson's (2002) prediction that COA would possibly be the latest audit generation (fifth) following Davis's (1996) description of four audit generations (see page 80 above). While it agrees with Higson's (2002) suggestion that it would be more appropriate for COA to be carried out by internal auditors because of its nature and logistics, this study advocates that both internal and external auditors may derive benefits from the use of COA.

Furthermore, these results indicate that certain techniques suggested by earlier study for the advancement of COA could be useful to auditors. These techniques include the use of digital agents to filter information (Helms, 2002); The Canadian Institute of Chartered Accountants' (1999) categorisation of COA reports into 'evergreen' and 'report on demand'; Searcy and Woodroof's (2003) six basic components required for a successful implementation of COA (see pages 78 - 79) and Omoteso et al.'s (2003) Continuous Intelligent Online Validation.

5.4.0: Proposition VII: Audit Automation Impacts on Auditor Independence

The audit profession has been faced with an age-long problem, auditor independence. The review of literature in the second chapter of this thesis discussed the various strands of criticism levelled against the profession in this regard. It also discussed the actions of audit regulatory authorities in this connection. However, this proposition attempts to determine the impact ICT might have on auditor independence.

The question relating to this proposition generates four classifications of responses from the interviewees. The first set of views indicates that auditors' use of ICT tools

and techniques has had no impact whatsoever on auditor independence. They think an auditor's comportment and physical interaction with clients impact on his/her independence rather than techniques and technologies.

"I think that will depend on how closely the auditor and the clients work together. I suppose if there is too close a working relationship, this could affect independence. It depends on how much gap is kept between the two parties as well as access level".

- An auditor with "big4"(b)

This group of interviewees also hold the belief that as long as auditors don't rely solely on clients' data and analysis, the interests of the shareholders and other stakeholders are bound to be protected by auditors' work and investigations.

"If managed effectively it should not impact on independence, as we would still be acting in the interests of stakeholders and we would be conducting our own analysis of client data".

- An institutional response from "big4"(a)

Lastly, they put forward the argument that human psychology suggests that independence is a function of the mind rather than physical interaction. As such, as long as auditors are able to observe their professional boundaries and ethical conduct, using either ICT or manual techniques should both guarantee the same level of auditor independence in an equal proportion.

"No, it doesn't. Independence is a state of mind rather than anything else. ICT or no ICT".

- An audit manager with a UK "big7" bank

The second opinion was held by just one respondent. This is the view that COA could make auditors more independent. The basis of this view is that since, all things being equal, ICT is expected to enhance audit quality, efficiency and effectiveness and make use of more data in its analysis with minimal level of errors and human interventions, its result should be more reliable and therefore more independent.

"Yes, it should provide a set of factual information. Therefore, this makes auditors more independent".

- An IS audit manager with a UK "big7" bank

In addition, question E10 focuses on ways in which ICT could enhance auditor independence. Only 29 respondents (39.2% of the total) answered this question. The pattern of the answer is as shown below in accordance with aggregate respondents' prioritisation:

i. Freedom to access more data
ii. Own audit trail in the client system
iii. Less contact because of remote access to information
iv. Creates room for considering other risk areas
v. Bias and subjectivity is reduced in sampling
vi. Standardisation of coverage by all auditors
vii. Better efficiency

Auditors' use of ICT tools and techniques will give them more data to work with especially with respect to audit evidence, testing and analysis without undue interference by clients and other parties as ICT reduces physical interactions.

The third category of interviewees hold the view that audit automation could have a negative impact on auditor independence. This is because operating sophisticated

ICT techniques such as COA may require a higher level of interaction of the external auditor with the client's activities. This part of the result confirms the fear of Alles et al. (2002) regarding the possibility of COA's sophistication trend in bringing closer the auditor and the audited system thereby possibly jeopardising auditor independence.

"From an external auditing perspective, yes. This is because you can tend to be perceived as part of the client's control environment. It might be better that the auditor allows management to carry on with COA and the internal control process and only come in when it is crucial to ask certain pertinent questions about the operations of the accounting system".

- A senior manager with "big4"(b)

Also, some audit firms are often hired to set up and maintain the computerised accounting information system for their clients. These activities are perceived to compromise these auditors' independence when it comes to the same firm auditing such clients.

"Yes, it might make us less independent if we are continually in contact with the clients. We have to be sure that we are not helping them with their system or telling them how to do things. We have to be seen as coming to audit and not auditing what we have told them to do".

- An auditor with "big4"(b)

"COA might do because if you have [a] continuous access to the client's financial system, that could compromise your independence as an auditor".

- An auditor with a city council

In addition, auditors might sometimes need to depend on ICT experts to access some data. Although most audit firms, particularly the large ones, do have

specialist ICT experts for such tasks, if such experts are from the client's organisation then this might jeopardise auditor independence,

"It could be. Relying on or requesting help from ICT experts/technicians. If we want to interrogate files, we may need access to those files. Sometimes, experts may need to write programs to extract the data we need. The onus is more on the auditor to ensure his/her independence".

- An IT audit manager with a city council

Similar views are expressed as responses to question E9, an open-ended one in the questionnaire regarding ways in which ICT could jeopardise auditor independence. 43 respondents (58.1% of the total) answered this question. The pattern of the answer is as shown below (according to respondents' aggregate prioritisation):

i. Overreliance on clients' IS/IT system
ii. Auditors' involvement in developing controls
iii. Lack of audit trail
iv. Audit programs substantially known to clients
v. Relying on clients' IT experts for data extraction
vi. Information sharing between clients and auditors

Again, these points compare well with the viewpoints of the independent set of interviewees as discussed above. This shows a consistency of opinion between the interviewees and the respondents.

The last group believe that audit automation could have both a positive and a negative impact on auditor independence depending on the prevailing circumstances relating to a particular audit engagement vis-à-vis data extraction

from the client's system by the auditor as discussed earlier in the penultimate paragraph.

"Possibly, it depends on how independent the auditor can be in getting data out of a system. If you are dependent on a system administrator to get the information, then, of course, your independence will be very much affected because if they choose to manipulate the data, your judgement would be affected. However, if you can have an assurance that you can independently get the raw data out of the systems exactly accurate and in the sense of reflecting the actual happenings, then it can enhance auditor independence".

- An audit manager with a city council

Apart from an audit engagement's circumstances, the nature and personality of the auditor in question is thought to be a strong factor in determining his/her independence.

"It probably could <damage auditor independence> as ICT softens the boundaries between things. Having said that, if you do get an auditor who is strict with boundaries, it could generate an independent report".

- An assistant audit manager with a city council

Although more interviewed auditors (internal and external) are of the view that ICT could make auditors less independent, most of their arguments are anchored on operational factors that may not apply in reality. These include auditors relying on ICT experts (although they could use their own ICT experts and technicians to perform complex ICT operations) and auditors serving as consultants to install ICT systems for clients among others. However a genuine fear may be the lack of security and integrity of data remotely transferred over distance.

As concluded by Alles et al. (2002), these arguments demonstrate that audit automation is likely to have an impact on auditor independence. However, the direction of this impact can either be positive or negative as this will depend on the circumstances surrounding an audit engagement and the nature, ability and personal integrity of the auditors involved in adhering to professional ethical codes and standards. This again brings into consideration the contingency theory of organisations which stipulates that there is no single point of optimality and there is a possible range of outcomes depending on a variety of factors, conditions and situations.

Similar to questions E1 to E3 relating to the signposts of auditor independence, the most direct question from section E on auditor independence, question E4 generated a WAS of 3.45, a polarised response between 'neither enhances nor inhibits' and 'enhances'. However, questions E5 to E7 which ask questions on various aspects (subsets) of independence such as professional expertise and competence produced a higher WAS that tend towards 'enhances'

		5 Strongly Agree	4 Agree	3 Neither Agree Nor Disagree	2 Disagree	1 Strongly Disagree	WAS
E1	Auditors rely too heavily on their clients' information systems for their audit	7 (10.4%)	22 (32.8%)	23 (34.3%)	15 (22.4%)	0 (0%)	222/67 = 3.31
E2	An auditor will compromise his/her independence by placing software agents/routines in a client's system and relying on them for audit judgement	1 (1.5%)	13 (19.4%)	26 (38.8%)	25 (37.3%)	2 (3.0%)	187/67 = 2.79
E3	Audit firms are quite often involved in the computerisation of their clients' accounting information systems	1 (1.5%)	30 (45.5%)	21 (31.8%)	12 (18.2%)	2 (3.0%)	214/66 = 3.24

		5 Greatly Enhances	4 Enhances	3 Neither Enhances Nor Inhibits	2 Inhibits	1 Greatly Inhibits	WAS
E4	Generally, audit automation ..... auditor independence	2 (2.8%)	30 (42.3%)	37 (52.1%)	2 (2.8%)	0 (0%)	245/71 =3.45
E5	The use of ICT tools and techniques ..... my professional competence	7 (9.7%)	46 (63.9%)	18 (25.0%)	1 (1.4%)	0 (0%)	275/72 = 3.82
E6	The use of ICT tools and techniques ..... the scope of my professional expertise	9 (12.5%)	37 (51.4%)	25 (34.7%)	1 (1.4%)	0 (0%)	270/72 = 3.75
E7	The use of ICT tools and techniques..... my fairness and sense of justice in forming my audit opinions	5 (7.0%)	27 (38.0%)	39 (54.9%)	0 (0%)	0 (0%)	250/71 = 3.52

The table below reveals that 51.4% (36 out of 70) of the respondents are neutral on the effect audit automation could have on auditor independence as against 45.7% that believe it enhances auditor independence while only 2.9% believe it inhibits auditor independence. This pattern tallies well with the shades of opinion obtained from the interview analysis.

B30 *E4		E4 Generally, audit automation ..... auditor independence				
		Inhibits	Neither Enhances Nor Inhibits	Enhances	Greatly Enhances	Total
B30 I utilise ..... for my audit assignments	Equal Proportion of ICT and Manual Techniques	0	9	6	0	15
	More Manual Techniques Than ICT Techniques	2	4	3	0	9
	More ICT Techniques Than Manual Techniques	0	23	21	2	46
Total		2	36	30	2	70

Table 5.5: Questions B30 and E4 (Crosstabulation)

Furthermore, of the 46 auditors who use more ICT techniques than manual techniques in their audit, 23 (50%) also believe that audit automation enhances auditor independence while the other 23 (50%) believe audit automation has no effect on auditor independence. Also, 3 out of 9 (33.3%) of those who use more manual techniques than ICT in their audit and 6 out of 15 (40%) hold the view that ICT enhances auditor independence. This indicates that there is no relationship between auditors' level of ICT use and their view on ICT's impact on auditor independence. This outcome is supported by a correlation coefficient of 0.14 as shown in the table below.

		E4: Generally, audit automation ..... auditor independence	B30: I utilise ..... for my audit assignments
E4: Generally, audit automation ..... auditor independence	Correlation Coefficient	1.000	.137
	Sig. (2-tailed)	.	.263
	N	70	69
B30: I utilise ..... for my audit assignments	Correlation Coefficient	.137	1.000
	Sig. (2-tailed)	.263	.
	N	69	72

Table 5.5a: : Questions B30 and E4 (Spearman's rank correlation)

From the foregoing analysis and discussion of data obtained from the questionnaire as well as interview excerpts, the strength of the interviewees' arguments and the discussions on these arguments in particular can make it reasonably safe to state that audit automation impacts on auditor independence, and this impact has both negative and positive sides to it. Although Vasarhelyi (2002) called for an enquiry into the impact of COA on auditor independence while Alles et al. (2002) asserted that the upward trend in COA's sophistication is likely to put auditor independence at risk, this study happens to be the pioneer empirical effort on the impact of ICT on auditor independence. Therefore, its results are open to future challenges.

5.5.0: Proposition VIII: Audit Automation Impacts on the Audit Expectations - Performance Gap

The Audit Expectations-Performance Gap (AEG) is a concept that is as old as auditing itself and this is why a school of thought believes the gap can never be filled (Sikka et al., 1998). As the dynamics of ICT have had possible effects on other professions, the motive behind this proposition is to assess the impact ICT tools and techniques could have on the AEG.

As in the last proposition, responses from the interview sessions generate four classifications on the subject. The first view shows that ICT has had no impact on the AEG as it believes that people's perception of the audit would be borne out of the perceived improvement or reduction in its quality and effectiveness.

"The quality of the audit produced dictates [the] society's expectations rather than ICT".

- The head of internal audit with a UK "big7" bank

However, if we can establish that the use of ICT enhances the quality of audit itself (which we were able to obtain from responses earlier considered in proposition 1 in chapter 4), then the argument above can be faulted. If one looks at it from the perspective of the numerous possible benefits accruing from audit automation in terms of quality, efficiency and effectiveness, then one can conclude that ICT should reduce the AEG as shareholders and other users of financial information should receive more reliable audit outputs. That is, we can argue that ICT can impact favourably on the AEG by reducing the gap as favoured by the second opinion.

In addition, the current developments in data mining whereby strings of data could be used to develop useful patterns which could be helpful in detecting fraud, errors and going concern problems might boost the effectiveness of audit and assurance services. Some recent KBES performing such feats are already in use (Leech et al., 1998). These will certainly help in narrowing the expectation gap.

One of the reasons why ICT might be able to reduce the gap is because ICT tools and techniques are bound to bring about a more reliable audit opinion based on comprehensive and sophisticated analysis as well as more reliable and sufficient audit evidence. This is indicated by a WAS of 3.83 on question C31 which shows

that the use of ICT tools and techniques makes it easier for auditors to gather reliable audit evidence.

"I think it could be a more controlled audit coming out of it. Therefore, people might be happier, so it might reduce the gap but not eliminate it totally. People will always criticise us".

- An assistant audit manager with a city council

Also, online facilities such as real time audit review and COA among others would allow auditors to spot problems as they occur and solve them before they escalate.

"It could narrow the gap. You can get a better assurance on the financial statements because of continuous monitoring and sophisticated ICT facilities. You can highlight problems quickly and sort them out straightaway".

- An auditor with "big4"(b)

Above all, communication facilities such as the Internet provide the opportunity to make the public better informed about what auditors are supposed to be doing according to statutes and what they are doing in reality. If such an understanding is enhanced, then the AEG will be reduced.

"If adopted widely, the gap could decrease. There will be a closer monitoring and that will bring what audit does more in line with what the public wants".

- An auditor with "big4"(b)

"I think the gap might narrow because the public might have more awareness of what the auditor is actually doing through ICT".

- An auditor with a city council

In a similar way, as a response to open-ended question F8 on the ways in which I think ICT could reduce the AEG, respondents identified certain ways through which ICT could reduce the AEG. Although only 22 respondents (29.7% of the total) answered this question, the pattern of the answer is as shown below (in order of respondents' prioritising):

i. Users' awareness of ICT weaknesses via ICT-based educational media
ii. Increased accuracy and validity
iii. Notes in the financial statements on the ICT impact on audit
iv. Standardisation of processes
v. Increase in the level of testing
vi. Public access to information about audit function via ICT
vii. COA may increase shareholders' confidence
viii. ICT alone can't do this

Users' awareness of ICT weaknesses via ICT-based educational media stands out as the main channel through which ICT could reduce the AEG while the only extreme position holds that ICT alone cannot solve the problem. This lone opinion, however, sounds very reasonable as the Audit Expectations-Performance Gap is so complex that a single solution cannot be found to the problem.

The third group of interviewees believe that ICT does increase the AEG as the tendency is high that people exaggerate ICT's capabilities and this increases their expectations with a consequently larger level of disappointment when these are not met.

"It could have a detrimental effect on the expectations gap i.e. it can create a bigger expectation. With COA, the audit role could be perceived as doing the management role as we are consistently monitoring the system and for specific events".

- An IS audit manager with a UK "big7" bank

"ICT can have the effect of potentially increasing the reliability and thoroughness of the audit review and the complexity of it. For example, you can do more sophisticated tests over the whole [of] population rather than a limited sample. Then the expectations from the audit can increase".

- An audit manager with a city council

"Possibly they might expect more. Because of the high profile of ICT capabilities, people might expect more than auditors might be able to provide".

- An IT audit manager with a city council

Similarly, question F9 in the questionnaire shed light on the ways in which auditors think ICT could increase the AEG even though only 22 respondents (29.7% of the total) answered this question. The pattern of the answer is as shown below (in order of respondents prioritising):

i. Thinking all errors and fraud will be identified (sampling and materiality may not permit this)
ii. Blaming misstatement on ICT
iii. Ascribing too much power to IT (infallibility and perfect results)

The thinking that all errors and fraud will be identified stands out as the main channel through which ICT could increase the AEG, whereas *"the reality shows that the compelling need for the application of sampling techniques and materiality threshold may not permit this"* (an anonymous respondent in the questionnaire).

Also, clients as well as the public might expect that auditors will scrutinise every transaction and account balance, perform all forms of test and access all evidence available before reaching a conclusion on the audit even though auditors have only limited time to spend on each engagement as this impacts on other engagements and the audit fees.

"It makes them expect more. They expect auditors to scrutinise every transaction and to be able to detect fraud, whereas, in reality, we can't do that. What we do is a risk-based assessment which will always yield limited results".

- An audit manager with a UK "big7" bank

"Perhaps, it might increase the clients' expectations from us because they know we have access to more information".

- An audit executive with "big4"(b)

"You've got to be clear with the clients from the start as to why you are doing it and what your parameters are. If a client gives you a full real time access to their system, they will certainly expect something fantastic at the end of it".

- An audit executive with "big4"(b)

Moreover, facilities such as COA and similar techniques make people presume that every error or fraud will be uncovered as they occur forgetting that other internal control leakages might jeopardise the effectiveness of such techniques.

"Possibly because of the fraud identification mechanism (no misstatement) whereas certain petty ones might still occur, therefore it might increase the gap. I will suggest a digital periodic auditing system because it would help the auditor on how best to understand and audit a business. The line of demarcation between internal and external audits with regards to the suggested periodic audit system is that external auditors should focus on things that might have a material impact on the financial statements. It might happen during the year but <with> more emphasis on post year end transactions/events whereas internal audit should be more focused on the process of internal control systems. They should both stick to statutes".

- A senior manager with "big4"(b)

The last group of respondents believe that although it is possible that ICT reduces the AEG as a result of reasons suggested by the second group above, the gap might eventually become wider as a result of increased expectations on the prevention and detection of errors and fraud.

"Initially the use of COA may reduce the expectation gap, as it should address a number of concerns that currently exist. However, as the process evolves we may find that expectations change and the gap opens up, perhaps becoming wider as there may be a greater expectation of the auditor to detect fraud through the use of these techniques".

- An institutional response from "big4"(a)

It is evident from the four classes of responses above that ICT could impact on AEG either positively or negatively as the last quotation indicates. It seems the impact these technologies might generate is a function of the perspective from which one looks at it.

However, being aware of the dynamics of modern technological tools and techniques, financial statement users might easily be tempted to expect more than the auditor could realistically deliver with the available technology. This is because the tendency is high to ascribe superpowers to ICT and this might increase the gap in the long run.

Furthermore, section F of the questionnaire is designed to test the impact of ICT on the AEG. Questions F3 and F6 generated the tables below:

F3: ICT has enhanced the understanding of financial statements' users regarding auditors' responsibilities as distinguished from those of the management

	Weight	Frequency	Weighted Response	Frequency %
Strongly Disagree	1	2	2	3.1
Disagree	2	15	30	23.4
Neither Agree Nor Disagree	3	34	102	53.1
Agree	4	13	52	20.4
Total		64	186	100.0

Table 5.6: Question F3 (Frequency Table) WAS: 2.91

F6: Users of audited financial statements are likely to ..... the effectiveness ICT could bring to audit

	Weight	Frequency	Weighted Response	Frequency %
Under-estimate	2	10	20	15.2
Neither Over-estimate Nor Under-estimate	3	29	87	43.9
Over-estimate	4	26	104	39.4
Greatly Over-estimate	5	1	5	1.5
Total		66	216	100.0

Table 5.7: Question F6 (Frequency Table) WAS: 3.27

Table 5.6 above shows that 26.5% of the respondents disagree that ICT has enhanced the understanding of financial statements' users regarding auditors' responsibilities as distinguished from those of the management, 53.1% are neutral while only 20.3% agree. However, from table 5.7, 40.9% of the respondents believe that users of financial statements are likely to overestimate the effectiveness ICT could bring to audit, 43.9% are neutral while only 15.2% believe financial statements' users are likely to underestimate it.

Similarly, other questions in this section (section F) of the questionnaire as shown below generate WAS ranging between 3.18 and 3.60. This indicates a response that tilts towards neither agree nor disagree.

		5 Strongly Agree	4 Agree	3 Neither Agree Nor Disagree	2 Disagree	1 Strongly Disagree	WAS
F1	The increase in the use of ICT by auditors has led to appropriate and relevant auditing standards being issued by the regulatory authorities	2 (2.9%)	23 (33.8%)	34 (50.0%)	9 (13.2%)	0 (0.0%)	222/68 = 3.26
F2	The increase in the use of ICT by auditors has led to sufficient auditing standards being issued by the regulatory authorities	1 (1.5%)	20 (30.8%)	34 (52.3%)	10 (15.4%)	0 (0.0%)	207/65 = 3.18
F4	Shareholders might to have increased confidence in audited financial statements if they were aware of the auditor's use of ICT tools and techniques	0 (0.0%)	27 (41.5%)	26 (40.0%)	12 (18.5%)	0 (0.0%)	234/65 = 3.60
F5	Other interested parties might have increased confidence in audited financial statements if they were aware of the auditor's use of ICT tools and techniques	0 (0.0%)	27 (41.5%)	27 (41.5%)	11 (16.9%)	0 (0.0%)	211/65 = 3.25

It is evident from these analyses that the responses from the scaled items in the questionnaire are as divided as those obtained from the interviewees and the open-ended questions.

We can also test from the crosstabulations below whether or not there is an association between auditors' level of ICT use and their opinion on ICT impact on the AEG.

B30 *F3		F3 ICT has enhanced the understanding of financial statements' users regarding auditors' responsibilities as distinguished from those of the management				
		Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Total
B30 I utilise ..... for my audit assignments	Equal Proportion of ICT and Manual Techniques	0	3	6	3	12
	More Manual Techniques Than ICT Techniques	0	4	4	1	9
	More ICT Techniques Than Manual Techniques	2	8	23	9	42
Total		2	15	33	13	63

Table 5.8: Questions B30 and F3 (Crosstabulation)

Of the 42 auditors who use more ICT techniques than manual techniques in their audit, 23 (54.8%) also believe that audit automation has no effect whatsoever on enhancing the understanding of financial statements' users regarding auditors' responsibilities as distinguished from those of the management while 44.4% and 50% of the other two groups share the same viewpoint. This indicates there is no clear cut relationship between the two variables and this result is reinforced by a correlation coefficient of 0.04 as shown below.

		F3: ICT has enhanced the understanding of financial statements' users regarding auditors' responsibilities as distinguished from those of the management	B30: I utilise ..... for my audit assignments
F3: ICT has enhanced the understanding of financial statements' users regarding auditors' responsibilities as distinguished from those of the management	Correlation Coefficient	1.000	.044
	Sig. (2-tailed)	.	.737
	N	63	62
B30: I utilise ..... for my audit assignments	Correlation Coefficient	.137	1.000
	Sig. (2-tailed)	.263	.
	N	62	72

Table 5.8a: Questions B30 and F3 (Spearman's rank correlation)

From table 5.9 below, of the 43 auditors who use more ICT techniques than manual techniques in their audit, 18 (41.9%) also believe that users of audited financial statements are likely to over-estimate the effectiveness ICT could bring to the audit, 19 (44.2%) believe they will neither over-estimate nor under-estimate that effectiveness while 44.4% and 38.5% of the other two groups hold the same belief. Again, this result indicates there is no definitive relationship between the two variables. Again, this result is supported by a correlation coefficient of 0.00 as shown in table 5.9a

B30 *F6		F6 Users of audited financial statements are likely to ..... the effectiveness ICT could bring to audit				
		Under-estimate	Neither Over estimate Nor Under-estimate	Over-estimate	Greatly Over-estimate	Total
B30 I utilise ..... for my audit assignments	Equal Proportion of ICT and Manual Techniques	2	6	4	1	13
	More Manual Techniques Than ICT Techniques	2	3	4	0	9
	More ICT Techniques Than Manual Techniques	6	19	18	0	43
Total		10	28	26	1	65

Table 5.9: Questions B30 and F6 (Crosstabulation)

		F6: Users of audited financial statements are likely to ..... the effectiveness ICT could bring to audit	B30: I utilise ..... for my audit assignments
F6: Users of audited financial statements are likely to ..... the effectiveness ICT could bring to audit	Correlation Coefficient	1.000	.002
	Sig. (2-tailed)	.	.989
	N	65	64
B30: I utilise ..... for my audit assignments	Correlation Coefficient	.002	1.000
	Sig. (2-tailed)	.989	.
	N	64	72

Table 5.9a: Questions B30 and F6 (Spearman's rank correlation)

The foregoing results from the interview excerpts and the open-ended part of the questionnaire show that auditors' use of ICT will impact on the AEG but there is no agreement on whether this impact will be negative or positive. Once more, this is the first study to examine the issue of ICT impact on the AEG and as a result it has not been possible to place its findings side by side with those of other commentators.

5.6.0: Conclusion

This chapter and the previous one have used appropriate analytical techniques to sift through the qualitative and quantitative primary data gathered to discuss and prove/disprove the eight propositions by matching the findings from the interview sessions with those from the questionnaire and, in the very few instances where these two present divergent views, efforts are made to resolve them based on logical rationality and the underlying contexts of the responses such as the

respondents' status and experience as well as the nature of the organisation they work for.

Some comparative analysis of the results of the study is also made side by side with the results of relevant previous studies in order to see what is different and why it is different as well as accentuating the new grounds the current study is able to break in order to push forward the boundaries of knowledge in the area of audit automation and associated disciplines. Above all, this chapter and the previous one have been able to apply the contingency, socio-technical systems and structuration theories in discussing the eight research propositions and rather than giving preference to one of the theories as the most useful, a conflation of the three would present a formidable model central to the understanding of the impact of ICT on auditing as discussed in the next chapter.

CHAPTER SIX

THE THREE-LAYERED MODEL

6.0: Introduction

This chapter presents the relevance of the contingency, socio-technical systems and structuration theories to this study as indicated by the results of the data analysis. It further explains the inter-connections among these three theories and suggests integrating them into a single but three-layered model in order to provide a more comprehensive insight into the understanding of ICT's impact on auditing. The chapter also discusses the significance of this model to the subject of audit automation and its applicability to previous studies in the area.

6.1.0: The Contingency Perspective

The contingency theory is primarily based on a heuristic concept that dissuades managers from adopting universalistic solutions and peddling panaceas (Wood, 1979). Therefore, within an organisational context, the following are the three basic principles of the contingency theory (Scott, 1987; Bartol and Martin, 1994):

i. There is no one best way to organise
ii. Different ways to organise are not equally effective
iii. The best way to organise depends on the nature of the environment to which the organisation relates.

Contingency theory attempts to explain structural and process differences among organisations with respect to their operating environment, technology, size, strategy and culture among others (Scott, 1987; Xiao et al, 1996). The relevance of these contingent factors, as relating to ICT's impact on auditing, is seen in the findings summarised below:

The study's findings support the idea that the huge cost required for audit automation may mean that only organisations with the financial capacity will be able to develop and continue with the use of ICT on a large scale. This is linked to the economic viability, efficiency and the size of clients being dealt with. This is further supported by the finding that the size of an organisation determines its audit automation level. It follows that large organisations, other things being equal, will be able to handle larger clients and have the financial wherewithal necessary for large scale automation.

Also, the analysis shows that senior auditors find real time audit review more beneficial than their junior counterparts. This finding supports that of Abdolmohammadi (1991) which suggested that more partners showed support for automation than managers. These results also corroborate the contingency theory in terms of the utility of real time audit as perceived at different levels of a firm. That is, the usefulness of real time audit review is contingent upon the level of the auditor inquestion.

The study also shows that the usefulness of real time audit review is contingent upon the nature of the clients in terms of size, geographical spread and sector of operation. Respondents are of the view that large dispersed organisations are more likely to benefit from real time audit review than small/medium sized and centralised public sector organisations.

The study further indicates that the impact of auditors' use of ICT tools and techniques on their independence depends on contingent factors such as the circumstances surrounding an audit engagement as well as the ability of the auditors involved to adhere to professional ethical codes and standards (see pages 216 - 225).

However, the study indicates that the use of ICT for audit is not contingent upon the internal/external nature of audit work as auditors from practising firms utilise more-or-less the same level of ICT tools and techniques as their internal audit counterparts. This result is contrary to those obtained by Carr (1985) and Wilson and Sangster (1992) which indicated that accountants in industry and commerce made more use of ICT than those in practice owing to the fact that accounting tasks in industry are more algorithmic while those in accounting firms require more in the way of judgement and the processing of qualitative information. This observation may be a reflection of the nature and quality of software increasingly becoming available, supported by greater hardware capabilities in terms of processing power and storage, enabling more complex tasks to be carried out. This study also found that senior level auditors who are ordinarily more involved in forming judgements utilise more ICT than their junior counterparts (see pages 153 – 155).

This study found that more experienced auditors use a higher proportion of ICT tools and techniques compared to manual techniques. This is evident in the fact that 57.7% of auditors with 1 to 5 years audit experience, 58.3% of auditors with 6 to 10 years audit experience, 64.3% of auditors with 11 to 15 years audit experience, 77.8% of auditors with 16 to 20 years audit experience and 75.0% of auditors with more than 20 years audit experience use more ICT than manual techniques in their audit assignments. It appears, therefore, that auditors' use of ICT techniques is contingent upon their experience and level of seniority. Similarly, the study shows that auditors tend to use a higher proportion of ICT for complex audit tasks than simple audit tasks (see page 182).

The above findings of the study lead to a general conclusion that although ICT does have an overall effect on an audit's quality and effectiveness, the extent of its impact is contingent upon the size of an auditing organisation, the client's size and control environment, the nature of the audit tasks in question, the cost of

technology as well as the auditor's experience level. This is in agreement with Sabherwal and King (1992), Gupta (1994) and Xiao et al. (1996) as briefly discussed below.

Sabherwal and King (1992) advocated the relationship between process attributes and contextual factors (IS function and external environment) as the basic requisite for the management of the decision processes for developing the strategic application of information systems. Gupta (1994) explained that the coordination and control of audit team members was shaped by the task environment and the technical nature of their work. Xiao et al. (1996) stressed that ICT's impact varies on different aspects of financial reporting and patterns of change were contingent upon environmental, organisational and managerial characteristics. Although Xiao et al. (1996) asserted that the contingency perspective makes ICT's impact predictable, their study lacked any empirical evidence to back its claim. This limitation is mitigated, to a degree by empirical data (quantitative and qualitative) as its findings broadly support the principles of contingency theory stated below:

i. **There is no one best way to organise:** this study shows that there is no one best way to utilise ICT tools and techniques in audit as the best way for each organisation will depend on its size and the size of its clients
ii. **Different ways to organise are not equally effective:** different levels or extent of ICT utilisation in audit might not yield the same level of audit effectiveness as this depends on auditors' experience level
iii. **The best way to organise depends on the nature of the organisation's environment:** the best way to utilise ICT in audit depends on the nature of the audit tasks (in terms of complexity) and the availability of appropriate software functionality.

Contingency theory has been criticised by Schoonhoven (1981) who argued that even though the overall strategy embedded in the theory is clear, its substance is

not. Similarly, Wood (1979: 342) summarised the criticisms levelled against contingency theory by a cross section of its antagonists as "the problems of goal conflict, multiple contingencies and the existence of different parties in an organization" which he reckoned proponents of contingency theory had tackled by suggesting making organisational objectives one of the contingencies (Legge, 1978).

Schoonhoven (1981) and Scott (1987: 507-509) advocated the importance of adding further theories to the contingency theory in order to enhance the understanding of ICT impact. Schoonhoven put forward the idea that contingency theory is an orienting strategy (or meta-theory) rather than a theory in the conventional sense suggesting that it might be more useful to use it as an underlying conceptual framework upon which other perspectives can be applied. Similarly, Scott observed that unless combined with another dynamic theory, contingency theory standing alone cannot offer a whole understanding of the different roles carried out by various management practices (in the forms of control and coordination) that are used in modern organisations. It is not surprising therefore that Warmington et al. (1977) used contingency theory as the base for the 'open socio-technical systems approach' for a better understanding of organisational change for improved performance while Gupta et al. (1994) combined contingency theory with institutional theory to investigate the forces that shape organisational structures for control and coordination.

As stated earlier in the literature review (page 90), one of the main criticisms of contingency theory is its inability to put the different parties within the organisation into consideration (Wood, 1979). These parties can broadly be grouped as human elements. However, it is important to put these human elements into consideration side by side with the material elements such as technology in order to achieve a meaningful organisational change. Giving a full consideration to both elements constitutes the main focus of the socio-technical systems theory.

6.2.0: The Socio-Technical Systems Perspective

The social system of any endeavour comprises people (including their attitudes, values, behaviours and interrelationships) while the technical system includes technology, processes, procedures and physical arrangements. These two systems form the foundation of the socio-technical systems theory which advocates the imperative of not privileging either of the two components at the expense of the other. In the case of this study, auditors (and the way they are perceived by all the stakeholders) constitute the social system while ICT tools and techniques make up the technical system.

The findings of this study indicate that IT audit and computer audit which involves auditing through the system would be impossible without the use of the technical dimension. Also, the study found that the aspects of audit testing, analysis, COA and data mining can be left largely to ICT processes. The study further shows that the use of ICT in audit could reduce auditors' creativity and their physical interaction with clients' environments. It also indicates that auditors are more likely to over-rely on ICT as a result of ICT's versatility.

In line with the conclusions of Ashton (1990) and Sutton et al. (1994), this study's findings reveal that even when auditors are using ICT tools (such as decision aids), they have to use their professional experience in taking crucial decisions as they stand accountable for such decisions and the blame for any wrong decision cannot be attributed to ICT. In addition, since every stage of the audit process requires one form of decision making or another, the two approaches (manual and technological) should be combined in an optimal way as shown in the quotes below.

"Performing complex calculations and data analysis that are often involved in audit tasks could be left for the technology while auditors play the diagnostic role of interpreting and working on the results of the calculations and conclusions.

However, the auditor cannot really leave the entire process to technology as he has to control and monitor the process (i.e. control-based system). He is to be blamed in case anything goes wrong at the end of the day. ICT remains just an aid..... In sum, you will need to mix the ICT and human element together and get the right balance. In some areas of the audit, ICT would be required and in some other areas, more human elements would be required".

- A senior audit manager with "big4"(b)

"I think you need both the technology support and human actors in all aspects of audit to achieve the best result".

- An audit manager with a UK "big7" bank

The socio-technical perspective advocates that, from an organisational viewpoint, the best of technology can only be realised with a due measure of the social actors (human auditors) to work and interact with it to produce an optimum result in terms of quality, efficiency and effectiveness. The theory further stipulates that both the elements need utmost attention and one element should not be given too much attention (in terms of maintenance and well being) at the expense of the other.

The socio-technical systems perspective adds to the contingency theory rather than advancing or negating it as aptly summarised by Wood (1979:1):

> *".... if contingency theory is taken to be more than simply a statement that there is no one best way of organizing, it implies a systems approach. Thus any attempt to overcome the weaknesses of systematic thinking imply a development away from, and not simply of, contingency theory."*

It is of interest to note that going by the review of the available literature in the second chapter, this study is one of the first to explicitly apply the socio-technical framework to the impact of ICT on auditing following the steps of Warmington et al.

(1977:12) who proposed an 'open socio-technical systems approach' for understanding organisational change and Orlikowski (1992) who advocated the framework for the understanding of ICT's effect on society.

Since Giddens looked at technology in the context of social structure, an appropriate theory to understand the impact of the environment and other contingent factors on the internal structures and processes of audit firms/departments and tasks is structuration theory as used by Manson et al. (2001) and Caglio (2003).

6.3.0: The Structuration Perspective

Structuration can be explained as the process of forming social interactions by virtue of the duality of structure, that is, the process through which social structures enable or constrain human action that are afterwards constructed and reconstructed by that action. Structuration theory has two main elements, structure and agency. Structures are rule-resource sets that reveal the outlining of productive social relations across time and space providing the context for integration (through instantiated actions of social agents) while agency is the ability of humans to act purposefully, knowledgeably and reflexively.

The theory proposes three properties of a social system. These are structure (rules and resources that can be classified as signification, domination and legitimation), modality (means to translate structures into actions i.e. interpretive scheme, facility and norm) and interaction (activity instantiated by the agent i.e. communication, power and sanction) (Giddens, 1984: 29). Giddens expanded further to suggest that rules are techniques and generalisable procedures inherent in producing any social practice (examples are communication codes, linguistic rules, technical directives and organisational norms) while resources are capacities to generate commands over material objects and abilities to direct human activities) that members draw upon.

The theory rejects the idea that structure and interaction are separable. It advocates that the duo should be considered as both the medium and the outcome of each other. (Giddens, 1984: 28). According to Clark (1990) as referred to in Rose (1998), the following represent a summary of structuration theory (a series of interrelated propositions):

i. It is social practices that underpin the constitution of individuals and society and not individual action or the experience of the individual actor nor the existence and requirements of societal totality
ii. Social practices are carried out by knowledgeable human agents
iii. The social practices are ordered and stable across time and space rather than being random or voluntaristic as actors draw on rules and resources (structural properties)
iv. Structure is activity-related. It is both the medium and outcome of a 'structuration' process.

The structuration perspective has been examined in this study through the effect audit automation might have on the number of auditors required by audit firms (from the point of view of recruitment and promotion) as well as the changes automation may bring about in the modus operandi and organisational structures of audit firm/departments. The findings obtained in these areas of focus relating to the structuration theory are discussed below.

The study's findings reveal that ICT skill is just one of the numerous skills that will be considered when recruiting an auditor as it is expected that a graduate with the requisite intelligence should be able to adapt to the technological environments obtaining in today's audit profession. Although ICT may be a determining factor where one of two candidates with similar knowledge and skill levels in other areas stands out in terms of ICT abilities. In contrast to recruitment, the study found that ICT abilities would be a necessary factor in auditors' promotion either directly or

indirectly. These findings show that audit automation has had a small indirect impact on the recruitment of new auditors, as suggested by Manson et al.'s (2001) findings, but a fairly significant impact on auditors' promotion (pages 189 – 195).

Furthermore, the study indicates that the more computerised an organisation is, the higher the number of its senior level professional and specialist staff. Also, it reveals that the more computerised an organisation is the lower the number of its administrative staff and junior level auditors. Combining these two findings, it will be correct to say that the more computerised an organisation is, the lower the number of its non-professional and junior audit staff in proportion to the senior level professional staff, at least in the short to medium term.

This conclusion tallies with the work of Wilson and Sangster (1992), which put forward the idea that the effect of ICT on accounting has been to increase the overall level of professional employment but marginally decrease the overall level of clerical employment. This study's finding indicates that ICT has taken over most routine and administrative tasks which had hitherto been carried out by junior staff within the firm/department. Also, developments in neural networks, continuous auditing and computer audit mean more jobs should be available to specialist auditors. However, as these sophisticated techniques are further developed, there is the possibility that the number of senior level auditors might reduce in the future. This finding corroborates the results of the works of Collier (1984) and Carr (1985) on the impact of ICT on accountants. The former found a unanimous agreement that the demand for clerical staff had fallen, while that for professional staff depended on factors such as economic prosperity. The latter was optimistic for qualified accountants since new jobs such as systems auditor would be created. Nevertheless, this study's findings deviate somewhat from those of Bagnall (1991) who suggested that the number of both clerical and professional staff in accounting firms is reducing as a result of automation. While it agrees with Bagnall on the

reduction in the number of junior staff, it shows that the number of professional staff increases rather than decreases.

Moreover, this study indicates that the increasing wave of audit automation is having an effect on the organisation structure, task structure and responsibility allocation in the audit profession. ICT can be said to herald some changes in auditors' working modalities and procedures which leads to a new signification structure which generates new roles and practices with corresponding new rules and concepts.

The above conclusion resembles the findings of Manson et al. (2001) and Caglio (2003). Manson et al.'s combination of structuration theory with Coombs et al.'s (1992) framework of culture, control and competition to explore the role played by audit automation as a form of control within audit firms. The study concluded that ICT could have direct impacts on audit firms' structures and processes as well as competitive position and recruitment strategies. Similarly, Caglio (2003) conceptualised the change in accountants' practices and positions due to the adoption of ERP as a structuration process.

As a result, by drawing on Giddens' structuration theory, this study has been able to conceptualise the current and potential transformation in the roles of auditors as a structuration process and ICT as modalities of structuration. ICT further provides new interpretive schemes, norms and co-ordination and control facilities that affect auditors' new roles in the modern assurance services and corporate governance (pages 202 - 205). ICT is therefore a form of mediator between automation (action) and an audit firm's /department's structure. Structure can be said to be contingent on the state of ICT development. This confirms the 'positive' dimension of contingency theory which Legge (1978: 97) described as a perspective which shows "*that it is contingencies in the organization's environment that influence the organisation's internal structures and processes*".

The adoption of the structuration theory provides an insight into the assessment of the impact the growth in ICT-based tools and techniques can have on *internal structures and processes* of audit organisations using certain contingent factors. The structuration theory complements the other two theories in a logical manner within the process of discussing the impact of audit automation on audit tasks, audit organisations and auditors. However, Giddens' theory has been criticised by social theorists. These criticisms revolve around the 'conflation' of structure and agency, that is, the problem of reducing structure to action (Rose, 1998).

Stones (2005:4) argued that "Giddens' concepts often require further development and refinement, as well as supplementation by other concepts from other writers". Stones' efforts towards this direction culminated in the 'strong' structuration framework in which he attempted to emphasis the limits of the applicability of structuration theory. He was of the view that the relevance of the theory will be based on certain prevailing situations in terms of times and places (ontology *in-situ*). This view corresponds well with the central themes of contingency theory which this study uses as the base (inner layer) of the three-layered model discussed below.

In addition, Rose and Jones (2004) criticised Giddens' structuration theory in understanding the relationship between ICT and organisations on the basis of its restriction of 'agency' to human capabilities. They believe that technology can also be 'agents', hence, they put forward a theoretical explanation of the interaction between human and technology agency which they tagged, 'the double dance of agency'. This 'double dance' is the main advocacy of the socio-technical systems theory as discussed in the last section. The socio-technical systems theory is therefore an important frame complementary to the structuration theory as it takes care of some of the latter's limitations.

In spite of the above criticisms, the usefulness of structuration theory in completing the emerging sequential frame necessary for understanding the impact of ICT on auditing cannot be stressed too strongly. However, the potential of the theory would be grossly undermined without the earlier two perspectives (contingency and socio-technical).

6.4.0: Towards a Three-Layered Model

The discussions on the aspects of the results directly relating to the three theories as described above reveals the inadequacy of any of the theories to single-handedly explain the use and possible impact of ICT on audit in a holistic manner. Contingency theory only provides the parameters that make the adoption and subsequent impact of ICT feasible in audits. The theory fails to show the importance of combining ICT tools and techniques with a suitable blend of human capabilities (with the presence of the outlined contingent factors) in order to achieve audit effectiveness. Taking care of this limitation of the contingency theory constitutes the cornerstone of the socio-technical systems theory.

However, neither the contingency theory nor the socio-technical systems theory could sufficiently explain the dimensions of the impact ICT's use can have on audit organisations as well as on auditors' roles and responsibilities. This identified deficiency is catered for by the structuration theory which shows that the increasing trend of using ICT tools and techniques could affect the structure of audit firms/departments and tasks by reducing the number of junior auditors, creating other specialist auditors such as IT auditor and restructuring auditors' tasks.

In addition, the contingency theory sheds light on the factors that are likely to shape the relevance and usefulness of ICT in audit thereby answering the 'what' question. Given the consideration of a combination of the contingent factors, the socio-technical systems theory will be useful in explaining the appropriate blend between technology (ICT tools and techniques) and auditors (junior and senior

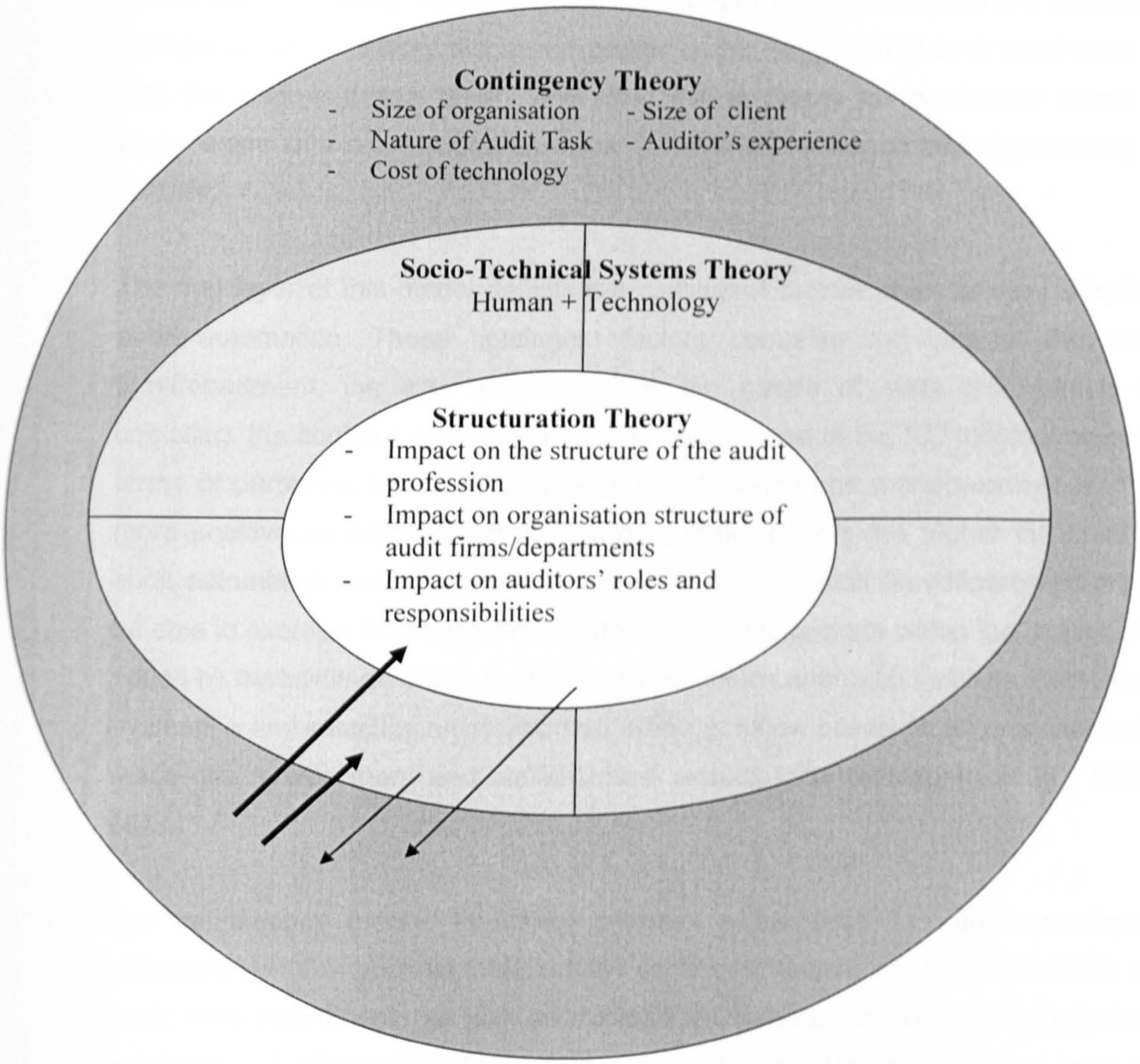
levels) thereby answering the question, 'how?' while the structuration theory assesses the dimensions of the impact of the mix of auditors and technology (based on the identified contingent factors) on the structures of audit organisations, tasks and personnel thereby answering the question 'where?'.

The above discussions on these three theories (the contingency, socio-technical and structuration) point to the relevance of combining the three theories into a single model that can give a better framework for the study of ICT's impact on auditing than any of the theories used in the current literature on the subject. This model advocates that:

The use of ICT in audits is a function of certain contingent factors that determine an optimal mix of human skills and technological capabilities, which would lead to changes in the nature of auditors' roles and outputs and audit organisations' structures.

The above conclusion can be depicted diagrammatically as shown below:

A Three-Layered Model



Note:

- The thick arrows represent the impact of contingent factors and environmental changes
- The thin arrows represent strategic choices made by organisations to counteract or benefit from changes in the environments

Figure 6.1: A Three-Layered Model of ICT Impact on Audit

Contingency theory is said to be an orienting strategy or meta-theory, suggesting ways in which a phenomenon ought to be conceptualised or explained (Schoonhoven, 1981). Combining this insight from Schoohoven with the limitations (criticisms) of the theory discussed earlier in this chapter makes it worthwhile to add the socio-technical theory and structuration theory as two further layers to make some of the considerations less abstract and enhance their applicability to real life.

The first layer of this model depicts the contingent factors (thick arrows) affecting audit automation. These contingent factors comprise the size of the audit firm/department, the size of audit client, the nature of audit task (simple or complex), the auditor's experience and the relative cost of the ICT tool/technique in terms of purchase, installation, training, maintenance and manpower needs. The more positive an organisation is regarding these factors the higher the level of audit automation and vice versa. In the short run, an audit firm/department might be able to exercise 'strategic choices' (thin arrows) to operate within the constraints posed by the contingent factors. The strategic choice approach involves identifying, evaluating and selecting an appropriate action to follow based on an organisation's resources, environment and stakeholders' expectations (Mintzberg et al., 1999: 59).

The contingency theory, therefore, provides a backdrop to any meaningful utilisation of ICT in audit as the identified contingent factors will focus the minds of audit firms/departments as well as auditors themselves towards the appropriate combination (optimal mix) of human and technological resources (second layer of the model). The second layer of the model suggests that the adoption of ICT tools and techniques requires an organisation to critically assess the contingent factors in relation to its current and potential staffing needs, financial position, nature of clients, activities of its competitors and the interest of its owners as well as all the stakeholders. The socio-technical systems theory emphasises the need to blend

objects such as ICT with relationships, as embodied in human auditors' characteristcs, in order to generate audit effectiveness. To further demonstrate the link between the first two layers, Warmington et al. (1977) used the contingency theory as a base-theory for the 'open socio-technical systems approach' which they advocated as being important in understanding organisational change for improved performance. Added to this, Stones' (2005) concept of 'ontology in-situ' as embedded in his 'strong' structuration theory (which he proposed as a refinement of Giddens' ideas) is analogous to the main tenets of contingency perspective advocated as the base of the three-layered model.

The third layer shows how the combination of the other two layers impacts on the organisation structure of audit firms/departments. This is indicated by the reduction in the number of non-professional staff and junior auditors who are being replaced by technology. Also, new sections/divisions are being created in audit organisations to cater for auditors with special ICT skills, hence, the prevalence of IS Audit as new units. In addition, the structure of auditors' roles and responsibilities are changing as they are generally moving away from the routine tasks involving number-crunching to concentrate on critical decision making issues.

As, according to Giddens (1984), the structuration theory explains how technology can be seen in the light of human capability to act purposefully and reflexively (agency) within the process of social interactions that produce structures, the theory could be explained within the contexts of power, authority, chain of command, inter-departmental and inter-organisational interactions as demonstrated below.

Elaborating on the structuration perspective further, the use of ICT makes audit organisations less bureaucratic as it bridges the gap that used to exist in communication before automation. The use of digital and online facilities has facilitated ease of communication across different levels of audit

firms'/departments' structures. Also, spans of control as entrenched in the structures of these organisations have become reduced as the study's findings indicate that ICT's use has further flattened the structures of audit organisations (pages 190 -195).

As a corollary to the above, the increasing trend in the adoption of ICT in audit assignments is very likely to make it easy for auditors at senior levels to delegate authority to their junior colleagues. This is likely to affect succession planning, training and performance evaluation as all these, to a large extent, are based on the structure of an organisation.

Also, ICT has the tendency to promote informal technical authorities. These are authorities that are borne out of special ICT skills possessed by certain auditors which enable them to exert some kind of influence on their colleagues. This happens as a result of the respect and recognition accorded these auditors (with ICT skills) notwithstanding the official positions they occupy in the organisation's chart. This is an aspect of likely impact ICT might have on the structures of authorities in audit firms/departments as shown in the interview excerpts below:

"....Here, we do have an IT audit section. By the nature of their work, they do form a power-base and other people I spoke to could sense that".

- An assistant audit manager with a city council

".... We do have champions in each department who are like problem shooters wherever the need arises. These people are accorded more respect though not real powers".

- An auditor with "big4"(b)

In addition, the third layer of the model also uncovers a new dimension of the impacts of auditors' use of ICT in their works on the organisations they work for, as

it sheds more light on the kind of support ICT gives to the smooth operations of joint audits between two (or) more audit firms as well as the ease with which external auditors can make use of the works of internal auditors whenever the circumstances permit this.

Furthermore, changes in the structures of audit organisations as heralded by the growth in audit automation are likely to generate a corresponding change in the overall strategies of these firms/departments. This viewpoint is based on Alfred Chandler's strategy-structure concept in which both the strategy and structure of any organisation are said to always influence each other (Chandler, 1962). However, these emerging strategies are best described as 'adaptive' as they are ideas introduced in response to new technological opportunities within the framework of the highly-volatile ICT environment.

While the primary consideration of this study and hence the primary applicability of the suggested model is at the level of a 'firm', it would be reasonable to expect that the model could also explain changes at the level of the 'profession', given a wider scope of inquiry and a different set of contingent factors – such as the current level and strategies for nurturing of human skills; current and emerging technological capabilities both in terms of technology as a direct performer and technology as a mediator.

Already, as evident in the first chapter, all the members of the CCAB, the Institute of Internal Auditors, ISACA and the Institute of Fraud Examiners are making frantic efforts to ensure that the use of ICT tools and techniques benefit their members maximally and that members keep pace with the challenges posed by ICT dynamism in carrying out their professional duties and responsibilities. However, given the foregoing thoughts, it will not be surprising to see the convergence of different classes of auditors such as external auditors, internal auditors, IS auditors and independent fraud examiners as a result of ICT mediation as is currently

happening in the manufacturing sector where the autonomous quality control machines have merged the production and quality control sections into one single unit without compromising the quality of outputs (Koper and Zaremba, 2000: 29).

ICT capabilities such as COA and decision aids can enable outsourcing within the audit profession, for example, some part of the audit tasks can easily be outsourced to auditors at far distances where labour costs can be much cheaper and necessary ICT facilities are available. In addition, a 24/7 audit approach can be obtained through outsourcing as auditors from different countries can work on the same engagement at different times as a result of geographical time differences. This may ensure a speedy audit and assignments that require a round-the-clock attendance can easily be achieved with minimal cost. Environmental contingencies favouring such action are globalisation (expansion of audit firms into global arena) and harmonisation (developing common standards and practices).

6.5.0: Relevance of the Model to Previous studies

In the light of the existing studies on ICT impact on audit, the significance of the three-layered model could be analysed further. Some of the studies expounded the benefits accruable from audit automation. These include enhanced quality, effectiveness, efficiency and consistency (Brown and Murphy; Bierstaker et al., 2001; Abdolmohammadi and Usoff, 2001). Although these impacts could be general to all categories of audit firms, the benefits are likely to be more pronounced in the large audit firms/departments. The contingency perspective is appropriate as the underpinning theory for such studies in order to gain a broad-based understanding of the studies' results. In addition, Abdolmohammadi's (1991) findings that the complexity of audit tasks and auditors' rank and specialty affect decision aids' applicability could have appropriately been underpinned by the contingency approach as the two factors identified could serve as contingent factors. Also, it is implied in the studies that the application of these ICT tools are to be combined with appropriate human capabilities (socio-technical approach) while

the outlined benefits derivable from the use of ICT are capable of leading to economies of scale which might invariably lead to certain structural changes in audit firms/departments (structuration approach).

Similarly, most of the existing literature on COA supports the idea that the technique will be more useful in large complex organisations than small simple ones (Kogan et al., 1999; Rezaee et al., 2001) just as Coderre (1995) concluded that the efficiency and effectiveness of the audit process as brought about by the use of CAATTs can only be realised in a situation of combined automated tools and techniques. Such conclusions would also have better explanations when viewed in terms of the three-layered model: combining situational contingencies and the social and technological structures.

Wilson and Sangster (1992) and Manson et al. (1997) posited that the use and impact of ICT on audit would be attainable depending on the presence of certain factors. Although the authors of the two studies did not explicitly apply contingency theory, their conclusions clearly reveal a contingency perspective . It is also interesting to note that Manson et al. (2001), using the same set of data as used in Manson et al. (1997), adopted a structuration perspective to discuss the impact of audit automation on audit firms. If the two studies (Manson et al., 1997; 2001) were combined into one, the socio-technical perspective would have been quite relevant as 'the bridging explanation' of the strategic imperative of combining human and technological attributes with a view to attain optimal outcomes with humans to attain the best outcomes.

The contingency theory would have fitted perfectly in Baldwin-Morgan and Stone's (1995) study that proposed a two-dimensional framework (matrix model) to address the multiple impacts of expert systems on accounting firms as discussed on page 72. Contingency theory would have provided their model with a broad-based background linking the model's 'categories of impact' (consisting of

eficiency, effectiveness, expertise, education and environment) and the 'levels of impact' (comprising industry, organisation, individual and task).

Eining et al. (1997) concluded that the use of expert systems (ES) enhances the auditors' ability to discriminate between situations of varying levels of management fraud risk as compared to either checklists or logit statistical models. This conclusion as well as similar ones advocating the superiority of ES could best be underpinned by the socio-technical systems theory. This is because the use of ES enables a combination of human intelligence with technological capabilities to produce results. In a related way, Arnold et al.'s (2004) study suggested that a balanced blend of user and technology may improve the expert decision-maker's decision quality.

Gupta et al. (1994) combined contingency theory with institutional theory to discuss the forces that shape organisational structures for control and coordination. Their study suggested that institutional theory demonstrates how expectations on suitable organisational forms and behaviour, as seen in the wider social environment, promote the development of an organisation's formal structure. Similarly, Rose and Jones (2004) combined structuration theory with the actor-network theory to develop a theoretical explanation of the interaction between human and technology 'agency' within an overall system comprising human and technological structures.

Flesher and de Magalhaes proposed that new audit technologies both automate previously existing audit procedures as well as introducing new audit approaches which might lead to systemic changes in internal audit departments' operations and cultures. Fischer (1996) concluded that the use of technology completely fashions new audit approaches rather than simply automating the then existing manual steps. These observations indicate the existence of both continuous and discontinuous changes in the restructuring of audit approaches which can only be

explained through the consideration of contingencies, strategic choices and the social/technological structures as proposed by the three-layered model.

6.6.0: Conclusion

This chapter has attempted to fulfil one of the cardinal objectives of the study by proposing a three-layered model as an integrated 'enlightenment' model to understand the impact of ICT on auditing. The three perspectives combined in the model have all been explained in the literature as meta-level theories as they encompass some other theories within their domains. Schoonhoven (1981) described contingency theory as an orienting or meta-level theory, Rose and Jones (2004) described the actor network-theory as a part of socio-technical systems theory while Giddens (1984) used the agency theory as a subset of structuration theory. Consequently, the interplay of these meta-level theories generates a synergistic frame within which the impact of ICT on audit can be understood. However, the same interplay makes the whole situation too complex to accurately predict the long-term scope and extent of ICT integration into audit.

As an outcome of an exploratory research effort, the model is presented to provide a richer framework for future research into audit and possibly into other fields of ICT-integrated human endeavour.

The next chapter presents an overview of the whole study in order to highlight its significance, contributions, limitations and suggested areas for further research.

CHAPTER SEVEN
CONCLUSIONS

7.1.0: An Overview of the Study

At the outset, this study aimed to examine the impact ICT has had and could have on audit tasks. This aim was subsequently broken down into seven objectives thus:

i. Identifying the current and potential relationships that may exist between ICT and auditing
ii. Assessing the roles ICT plays in structuring audit firms/departments as well as auditors' roles and responsibilities
iii. Examining the relative usefulness of ICT to auditing with respect to certain contingent factors
iv. Assessing the current state of COA's use and its potential for auditing and financial reporting
v. Examining the part ICT plays in the debate on auditor independence
vi. Assessing the effect ICT might have on the Audit Expectations-Performance Gap
vii. Identifying the best framework applicable to studying ICT's impact on auditing

The research objectives above were restructured into eight propositions after reviewing the literature on Auditing and ICT and identifying the gaps that currently exist. These propositions were:

1. ICT has had a positive impact on auditing

2. Auditors' use of ICT tools and techniques renders manual techniques obsolete

3. The extent of ICT utilisation for audit assignments is affected by audit firms' and clients' size, nature of audit tasks and auditors' experience

4. ICT does have potential ways of impacting on auditing

5. Audit automation affects the structure of an organisation

6. COA could be considered the future of auditing

7. Audit automation impacts on auditor independence

8. Audit automation impacts on the Audit Expectations-Performance Gap

The identified gaps from the literature review were meant to be filled by this research to prove or disprove the above propositions thereby moving forward the current frontiers of knowledge in the field. This process of reaching meaningful conclusions on the propositions above involved data collection through appropriate research instruments (semi-structured interview and questionnaire) and subsequent analysis of these data using suitable qualitative and quantitative techniques. These analyses were carried out to assess the current implications and future directions of ICT on audits (chapters four and five) with a view to making some original contributions to knowledge which are highlighted below.

The study has been able to identify the current and potential interactions that exist between ICT and Auditing and the benefits and drawbacks of such a symbiotic relationship. The study shows that ICT has contributed positively to the efficiency and effectiveness of audit in terms of accuracy, adequacy of documentation, consistency and quality of working papers, possibility of timely identifications of errors, thoroughness, reliability and ease of linking current to the previous year's work. In spite of these benefits, the upward trend in ICT sophistication and

adoption has not been without its attendant problems. According to the study's findings, these problems include the huge cost required by firms to keep pace with ICT developments, over-reliance on ICT at the expense of human skills and sense of judgement, possibility of increase in electronic fraud health hazards and lack of personalisation.

In addition, as far as the UK is concerned, this study is privileged to be one of the first empirical efforts on the relevance and potential of COA to both internal and external auditors. Similarly, the study has been able to contribute, from the ICT perspective, to the debate on two longstanding phenomena within the audit profession, auditor independence and the Audit Expectations-Performance Gap. Above all, drawn from the data analysis, the study has presented a three-layered model (integrating the contingency, socio-technical systems and structuration theories) for the understanding of the impact of ICT on auditing.

By drawing together the strings of the discussions and analysis from the previous six chapters, the remainder of this chapter recapitulates the essence of the study with respect to its key results and the contributions of these results to knowledge in the area of audit automation. The chapter also identifies the inherent limitations of the study and uses these as a springboard to suggest some important areas of direction for future research on related topics.

7.2.0: ICT and Auditing: The Current State of Affairs

As regards the key aspects of audit that benefit from the use of ICT tools and techniques in audit, this study finds reporting, planning, recording, data analysis, communicating (among audit team members, with the client and third parties) as well as controlling of audit tasks as the foremost audit tasks that benefit most from the use of ICT. This is followed by preparing financial statements and verifying ledgers, analytical review, researching clients and assessing risks; the next set of audit tasks includes verifying process logic, storing data, illustrating findings and

presentations, standard schedules and managing while the last set of tasks comprises monitoring, sampling, reviewing others' work, tracking audit recommendations and testing.

The study also finds that the aspects of audit that benefit least from ICT implementation include interfacing with clients (in the forms of meetings, briefings, interviews, discussions etc), managing staff, physical verifications (of invoices, payment vouchers, cheque stubs etc) and expressing opinions (judgements) belong to the first group of tasks. The next set of tasks identified consists of analysing control systems and cross referencing between working papers while the last set of tasks comprises substantive testing, paper files review and detection of fraud and money laundering.

The study overall shows that ICT has substantially benefited the audit process and enhances audit efficiency and effectiveness. Although previous studies touched on some of these areas of audit vis-à-vis ICT application (Carr, 1985; Institute of Chartered Accountants in England and Wales, 1989, 2003; Manson et al., 1997), the result of this study is more comprehensive and it updates the literature with current perceptions and trends on the subject.

In addition, the study's findings show that: large organisations are likely to use more ICT tools and techniques than small and medium organisations; auditors are likely to use more ICT techniques for large clients than for small/medium sized clients; the use of ICT tools and techniques in audits will be more widespread as the cost of technology decreases; ICT tools are likely to be used to a greater extent for complex audit tasks than for simple ones; senior level auditors who are ordinarily more involved in forming judgements based on their experience favour a greater use of ICT than their junior counterparts; senior level auditors consider real time audit review more beneficial than their junior counterparts; large dispersed organisations are more likely to benefit from real time audit review than

small/medium sized and centralised public sector organisations. Thus, there is a clear indication that the use of ICT tools and techniques is contingent on the nature of the audit, the size of the firm/client, the auditor's experience and the cost of technology.

Furthermore, the study shows that ICT related skills do not play a significant part in the recruitment of new auditors, however, proficiency in the use of ICT based tools and techniques has a significant impact on auditors' promotion. Also, the findings indicate that a greater degree of computerisation of an audit firm/department leads to a decrease in the number of its non-professional and junior audit staff while increasing the requirement for senior level auditors. The study therefore shows that audit automation is having an effect on the organisation structure, task structure and responsibility allocation in audit firms/departments.

7.3.0: ICT and Auditing: Potential Applications

As ICT remains a dynamic phenomenon, this study has been able to shed light on the areas of audit that can further benefit from the utilisation of current and emerging ICT tools and techniques. The study shows that auditors, particularly external auditors working with the "big4", are eager to exploit the capabilities of more sophisticated technology tools such as artificial intelligence and process models to gain a better insight into the operational details of their clients and the industry under which these clients function. This kind of broad-based knowledge and understanding provides a clearer context to the audit assignments and helps the auditor in conducting the audit and expressing the final audit opinion. The respondents are of the view that since every stage of the audit process requires one form of decision making or another, the sophisticated ICT tools need to be combined optimally with human skills in order to achieve the best audit outputs in terms of efficiency and effectiveness.

It is interesting to note that respondents are clamouring for the integration of ICT with corporate objectives for control purposes when the main points of their advocacy is already summarised in COBIT. Championed by the Information Systems Audit and Control Association, COBIT is currently in its third edition (ISACA, 2005).

Data transfer from clients' systems to those of auditors has been identified by the respondents as a major cause for concern to auditors. Little wonder then that they suggest that resolving this is a significant way ICT could benefit auditors further. As a respondent stated, ICT should solve the problem it has created in the first instance.

The study also indicates that continuous improvement of the current computer-based audit tools and techniques is necessary. This might be as a result of the upward trend in ICT sophistication and increased efforts towards perfecting audit tasks to the satisfaction of shareholders' needs as well as the needs of other users of audited corporate financial statements. As continuous improvement constitutes one of the cardinal principles of Total Quality Management (TQM) (Semicon, 2003), this finding underscores the relevance of the approach to audit automation. The finding corroborates the view of Bierstaker et al. (2001) who predicted that ICT was likely to continue to have a continuous considerable positive effect on audit for the foreseeable future.

7.4.0: Continuous Online Auditing

As online business transactions continue to be on the increase, efforts are mounting on the technological feasibility and the financial and economic viability of COA (Alles et al., 2002; Vasarhelyi, 2002; Pathak et al., 2005). This study attempted to look at the possible benefits and drawbacks of COA in order to assess its relevance to the future of both internal and external auditing. As regards COA's benefit, the results can generally be categorised into two. The first category

comprises quick discovery and investigation of errors and fraud, reduction of post year end intensive work level, time saving, adequacy, sufficiency and reliability of audit evidence. The second category consists of timely feedback to clients and other users, assurance of data accuracy, instant capture of transactions and control breaches and easier review.

However, COA could serve as a barrier to the occurrence of errors and frauds with the use of sophisticated ICT tools and techniques. These can be greatly enhanced through the design and use of appropriate artificial intelligence to function as Continuous Intelligent Online Validation (CIOV). CIOV is said to be capable of enhancing both the detective orientation (ex-post) and the preventive orientation (ex-ante) of COA (Helms, 2002; Omoteso et al., 2003).

The study shows that the most commonly mentioned way in which COA could jeopardise audit effectiveness is over-reliance on it at the expense of other assessment mechanisms. Mention is made to a lesser degree of security issues such as system bugs, COA's intrusive tendency and the possibility of fraud if clients' staff know too much about its workings.

Furthermore, the study indicates that COA could generate high powered instantaneous analysis of raw data which can make it possible to identify problems early and communicating the uncovered problems (e.g. internal controls deficiency) to the management for prompt corrective action. This is concisely expressed by one of the interviewees:

"I think it will be nice to have the internal and external audit process integrated through COA where they can work hand in hand.....".

The quotation above captures the responses from other interviewees as the trend of the responses show that COA is presumed to be beneficial to both internal and

external auditors depending on the perspective from which each respondent looked at it. This shows that COA could indicate the possibility of a move towards the integration of both internal and external audit to improve the overall control environment and to provide a firm basis for assurance purposes.

The study's findings show that the readiness of audit professionals and their clients to adopt COA is still a contentious issue with some in favour and some against. It also signifies that the limitations of COA as identified could be overcome through adequate awareness, training on and promotion of the workings and benefits of COA as earlier highlighted, introducing some degree of flexibility without compromising audit integrity, introducing management accounting controls and strengthening systems protection and care to prevent hacking.

7.5.0: ICT and Auditor Independence

Assessing the impact of ICT on auditor independence, respondents' views are polarised. Some believe audit automation can enhance auditor independence while others argued it will jeopardise auditor independence. The study finds that ICT could enhance auditor independence as a result of various factors: the auditors' ability to access more data; the ability to generate their own audit trail in the client system; less contact with clients' staff because of remote access to information; ICT creates room for considering other risk areas; bias and subjectivity is reduced in sampling; standardisation of coverage by all auditors; and enhanced efficiency.

However, most of the arguments that support the view that ICT could make auditors less independent are hinged on certain possible operational aspects of ICT. These operational aspects can nonetheless be curtailed in reality. They include auditors relying on ICT experts and technicians to perform complex ICT operations, auditors serving as consultants to install ICT systems for clients and auditors' frequent visits and interaction with clients all the year round as a result of COA operations. The study therefore concludes that audit automation could impact

on auditor independence either positively or negatively, but this will depend on contingent factors such as the circumstances surrounding an audit engagement and the nature and ability of the auditor involved in adhering to professional ethical codes and standards.

7.6.0: ICT and the Audit Expectations-Performance Gap

A better insight was obtained on this aspect of the study through the interviews, the quote below from "big4"(a) summarises the findings of the study.

"Initially the use of COA may reduce the expectations gap, as it should address a number of concerns that currently exist. However, as the process evolves we may find that expectations change and the gap opens up, perhaps becoming wider as there may be a greater expectation of the auditor to detect fraud through the use of these techniques".

It appears that ICT's role in this connection is contingent on the viewer's perspective. Those who look at it from the angle of the numerous possible benefits accruable from audit automation in terms of quality, efficiency and effectiveness can easily conclude that ICT should reduce the expectations gap as shareholders and other users of financial information receive more reliable audit outputs. This is in addition to the numerous ICT-based media such as the internet through which the public could be educated on what the auditor's real responsibilities are as well as increased accuracy, validity and quality of information.

On the other hand, those who are aware of the prowess and capabilities of modern technological tools and techniques among the financial statement users might easily be tempted to expect more than what the auditor could realistically do with the available technology and auditors' currently limited ICT skills and abilities. Also, people might overestimate ICT's capabilities. These exaggerated views include the infallibility of computerised systems and the notion that computers always generate

perfect results. As a result of all these factors, ICT might increase the gap in the long run.

However, this study's result indicates that ICT has been helpful in performing audit tests and analysis and there has been a wider use of the internet, mobile technological devices and artificial intelligence agents. We can conclude based on these results that auditors' performance deficiency in terms of coverage and scope should be fast reducing and tending towards zero but the standard deficiency aspect cannot be influenced by audit automation as this is entirely up to the standard setting authorities (see Figure 2.1 on page 25); though ICT can provide a communications infrastructure for wider consultation and dissemination.

A further dimension to the expectations gap relates to real-time reporting (making digital information available as soon as it is created), which is beyond the scope of this study. An evaluation of this approach, discussing the very real dangers it poses, has been provided by Higson (2003).

7.7.0: The Three-Layered Model

The contingency, socio-technical systems and structuration theories were drawn from the literature as capable of underpinning a study on the impact of ICT on auditing. In the beginning, the three theories were adopted for this study with a view to determining which of them will be most suitable for the analyses and conclusions on the propositions in chapters four and five. However, the analyses indicated interconnections among the three theories which integrate them into a single but three-layered model. This model significantly enhances the study's investigation of ICT impact on auditing. The model uses the contingency theory as the bedrock upon which the other two theories were built for a meaningful understanding. The model was also found useful to the findings of a number of past studies on audit automation. The interplay of these meta-level theories as

explained in the model is bound to generate a synergy in the understanding of ICT impact on audit.

The model postulates that the use of ICT in audits is a function of certain contingent factors (nature of the audit, size of the firm/client, auditor's experience and cost of technology) that determine an optimal mix of human skills and technological capabilities, which would lead to changes in auditors' roles and outputs, audit organisations' structures and the structure of the audit profession.

7.8.0: Possible Implications of the Study for the Audit Profession

The foregoing conclusions are expected to be of value to the audit profession particularly in the following ways:

i. The result of this study in comparison with previous studies such as Carr (1985) and ICAEW (2003a) indicates that there is a steady upward trend in the use of ICT by the audit profession and the extent of this upward trend is dictated by the increase in ICT sophistication.

ii. Although the finding that audit automation has led to a reduction in the number of junior auditors affects juniors auditors' employment and training opportunities in the short run, there are longer term implications for the availability of an adequate number of senior auditors as it is the junior auditors who metamorphose into senior auditors (in terms of acquiring the necessary experience to be able to undertake and sign off audits in the future).

iii. As a corollary of the above, if junior auditors must be recruited with a view to becoming senior auditors in the future, then the question will be what alternative ways are available to train these junior auditors given the limited opportunities to gain practical hands on experience of auditing situations.

iv. Alternatively, will newly qualified accountants be diverted to other areas of accounting practice such as accounts preparation, business advice, taxation and other areas such as fraud examination and forensic accounting rather than being junior auditors?

v. As a way out of the problem of training up-and-coming auditors, it is suggested that simulation techniques can be used to depict real life situations or scenarios. Also practical case study auditing assignments and expansion of the computer audit part of auditing papers and modules might equally be of help. In addition, the area of computer audit or IT audit could be strengthened and further publicised by the CCAB members by running special diplomas on the subject similar to the ICAEW's diploma in International Accounting Standards. The Institute of Internal Auditors in the UK and Ireland has adopted this approach.

vi. Audit regulators will still need to rise to the challenge by educating the public through various modern ICT facilities such as the Internet on what audit is and what audit is not in order to close the AEG as shown in the results.

vii. An important consideration, especially following the continuing recent trend of increasing capabilities and reducing costs of ICT hardware and software, is whether ICT, in the longer run, can provide a more level playing field for small and medium sized firms and nurture their growth. As Warner (2005: 57) observed, "Already limited competition among practices capable of undertaking a global audit or due diligence was further reduced when the big five became the big four: any new shrinkage and the wheels of global commerce would grind to a halt. It would be virtually impossible to find a practice which wasn't already conflicted out if there were just three".

7.9.0: Limitations of the Study

The nature of the study, a doctoral research work, imposes some restrictions on the extent of scope and coverage of the study due to time and financial constraints. Otherwise, other robust data collection techniques such as experiments, observations and longitudinal approaches would have been more useful. Also, while difficulties were encountered in terms of the reluctance of organisations to participate in the study, yet it was even more challenging persuading auditors in the participating organisations to take part in the research either in the form of interview or questionnaire completion. The validity of the results especially those that relate to the contingent factors could have been greatly enhanced with a higher number of returned questionnaires than the seventy-four used in the quantitative analysis.

The respondents chosen for the study were extremely busy and their participation in the study was on the basis of availability and interest. Hence, purposive rather than random sampling was used. Therefore, the lack of random selection might have had some effects on the research's results. In addition, the sample size for the study was relatively small and as size is directly linked to the power of statistical tests, a higher number would have added to the validity and generalisability of its results.

As a corollary of the above, some of the returned questionnaires contained blank responses to certain aspects (questions) of the questionnaire. This imbalance in responses to different variables in the questionnaire makes it impossible to perform some of the analytical procedures such as regression, difference of means and more detailed correlations (based on parametric statistical tests) to investigate the propositions on the data obtained.

It is also worthy of note that some of the participating "big4" accounting firms only permitted an institutional response, that is one single response as representing the firms' opinions (see appendix D). In spite of the limitations discussed, the choice of a triangulation of data collection methods reduces the effect these problems could have had on the study and hence its results can be considered fairly representative.

7.10.0: Recommended Areas for Future Research

Based on the contributions and limitations of this study, it is suggested that future research in the area of audit automation could focus on the impact of ICT on internal control systems using a case study approach, the impact of audit automation on corporate governance and a cross sectional study on stakeholders' views on ICT's impact on audit in the US, UK, Canada and Australia among others. Furthermore, future research may investigate the impact of web-based attestation sevices such as AICPA/CICA initiated WebTrust on the Audit Expectations-Performance Gap.

The recent legislation on corporate governance effectiveness by regulatory authorities such as US's Sabarnes-Oxley Act constitutes another perspective to audit automation. Therefore, future research could assess whether these regulations might have effects on the applicability of certain ICT tools and techniques useful for audit.

Since the study was able to identify ICT as a strong factor that can impact on auditor independence and the Audit Expectations-Performance Gap, future research can probe deeper into other specific aspects of ICT such as EDP, KBES, real-time audit review, COA, decision support systems etc. Also, future studies can make use of secondary data such as annual financial statements of corporate organisations to assess ICT impact on performance rather than just asking employees' opinions on their organisations' performance.

Based on Prahalad's (2005) view that more and more service-related activities are being outsourced as a result of digitisation, inexpensive communication and ubiquitous connectivity, it is recommended that future research could probe into the possible effects sophisticated ICT tools and techniques might have on outsourcing audit tasks especially with the developments in neural networks and KBES for decision making.

Finally, as a result of the exploratory nature of this research, it will be interesting to see how future research efforts on audit automation will be able to react to the three-layered model in terms of corroborating or contradicting it based on further empirical studies. By extension, it is anticipated that this model might be useful for the study of the impact of any form of technology on endeavours such as business and society.

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APPENDIX A

Ethical Approval for the Study

Faculty of Business and Law

Approval of Research Activity Involving Human Research Ethics

This form is to be used by any member of staff or student gathering information about human beings (and organisations) through:

a) interviewing
b) surveying
c) questionnaires
d) observation of human behaviour

Information gathering about human beings in the Faculty mainly involves interviews and questionnaires of a standard and simple pattern. The MRS Code of Conduct meets the professional standards of the ESOMAR Code of Marketing and Social Research Practice and is the world's largest international membership organisation for professional researchers and is, therefore, deemed the most appropriate basis for work in the Faculty.

The Faculty specifically forbids such activities with respect to:

e) taking human tissue/fluids
f) interfering in normal physiological and/or psychological processes

This form complies with the DMU policy statement on Human Research Ethics; a full copy of which can be found in the General Regulations and Procedures Affecting Students.

A separate form is required for each project

Staff/ Student Name KAMIL OMOTESO **Programme/Diet** Ph.D. (FULL TIME)

Title of Research Project AUDIT AUTOMATION: THE IMPACTS OF INFO-TECH-ON AUDITING

I agree that in conducting the above research project I will comply with the Market Research Society Code of Conduct as published in their revised July 1999 statement. The rights of respondents are recognised in sections B3 through B8 of the code as listed on the reverse of this form. In cases where it is inappropriate to provide written statements respondents will always receive a verbal statement that their co-operation is voluntary, that anonymity will be preserved, and the purpose for which information is being collected.

I further agree that I will always carry with me and show to respondents my staff/student identification card.

Signature of Researcher/Student [signature] **Date:** 22/10/2002

Signature of Director of Studies/ Supervisor: [signature] **Date:** 22/10/2002

Signature Confirming Approval by Designated Officer [signature] **Date:** 25/10/02

Rules

B. ICC/ESOMAR Code of Marketing and Social Research Practice

THE RIGHTS OF RESPONDENTS

B.3. Respondents' co-operation in a marketing research project is entirely voluntary at all stages. They must not be misled when being asked for co-operation.

B.4. Respondents' anonymity must be strictly preserved. If the respondent on request from the Researcher has given permission for data to be passed on in a form which allows that respondent to be identified personally:

(a) the Respondent must first have been told to whom the information would be supplied and the purpose for which it will be used, and also
(b) the Researcher must ensure that the information will not be used for any non-research purpose and that the recipient of the information has agreed to conform to the requirements of the Code.

B.5. The Researcher must take all reasonable precautions to ensure that Respondents are in no way directly harmed or adversely affected as a result of their participation in a marketing research project.

B.6. The Researcher must take special care when interviewing children and young people. The informed consent of the parent or responsible adult must first be obtained for interviews with children.

B.7. Respondents must be told (normally at the beginning of the interview) if observation techniques or recording equipment are used, except where these are used in a public place. If a respondent so wishes, the record or relevant section of it must be destroyed or deleted. Respondents' anonymity must not be infringed by the use of such methods.

B.8. Respondents must be enabled to check without difficulty the identity and bona fides of the Researcher.

APPENDIX B

Introductory Letter for Data Collection

www.dmu.ac.uk
DE MONTFORT UNIVERSITY
LEICESTER • BEDFORD • MILTON KEYNES

Leicester Business School
Graduate Centre

Professor Elaine Harris
MBA ADipC DBA FCCA DipM FCIM FRSA ILTM

Head of Department of Accounting and Finance
& Head of Postgraduate Studies

Tel: 0116 257 7259
Fax: 0116 250 6043
Email eharris@dmu.ac.uk

10th February 2004

Re: Kamil Omoteso

This is to confirm that Kamil is currently carrying out research on the impact of Information and Communications Technology on auditing in the Department of Accounting and Finance, Leicester Business School, De Montfort University.

The study is in partial fulfilment of his Doctor of Philosophy degree and I can confirm that the University code of conduct on ethics and associated procedures will be followed in this research. Therefore, respondents and focus organisations are guaranteed their anonymity and confidentiality.

I shall be grateful if co-operation and assistance are accorded him and that you will contact his supervisor, Dr Scott, in case of further enquiries.

Yours faithfully

Elaine

Professor Elaine Harris

c.c. Dr P Scott

APPENDIX C

Interview Questions

Interview Questions

PhD Research Topic:
The Current and Potential Impacts of Information and Communications Technology on Auditing

Kamil Omoteso, Department of Accounting & Finance,
Leicester Business School, De Montfort University, Leicester

Introduction

For the purpose of this study, Information and Communications Technology (ICT) is considered to include the use of systems among which are computers, microelectronics and telecommunications for storing, retrieving, sorting, analysing and transferring information. Its adoption ranges from the use of computer hardware and software, data telecommunication and the internet (in planning, controlling, recording and reporting audit tasks) to the use of decision aids such as expert systems, neural networks and artificial intelligence in audit decision making.

This study places a special focus on Continuous Online Auditing (COA) otherwise referred to as real-time or concurrent auditing. COA is a comprehensive electronic process that enables auditors to provide some degree of assurance on continuous information simultaneously with, or very shortly after, the disclosure of the information, achieving these through Real Time Accounting (RTA) systems. COA has both detective orientation and preventive orientations. The first orientation serves a similar purpose with the traditional audit of examining 'historical' records and books of accounts to derive audit evidence, whereas the latter could serve as a barrier to the occurrence of errors and frauds with the use of sophisticated ICT tools and techniques. These can be greatly enhanced through the design and use of appropriate artificial intelligence to function as Continuous Intelligent Online Validation.

ICT and Audit Tasks

1. In your opinion, what are the possible benefits/drawbacks of using ICT in audit
2. Which areas of audit could benefit from further utilisation of ICT?
3. Which areas of audit do you feel can be left exclusively or dominantly for the use of ICT techniques?
4. Which areas of audit do you feel should be left exclusively for human auditors (manual)?
5. What are the possible benefits/limitations of real-time audit review?

ICT and the Organisation

6. In what ways do you think ICT use in audit has affected the structure of your organisation in relation to power, authority and chain of command?
7. Does the size of your firm affect the level of its audit automation?
8. Would the size of a particular client affect the level of its audit automation?
9. Would the type of your firm's service/product affect the level of its audit automation?

ICT and Continuous Online Auditing (COA)

10. Do you see any role for COA in improving the internal and external audit process?
11. Are you aware of any limitations of COA?
12. Can you suggest any improvements that might enhance these limitations
13. Could ICT/COA have any impact on auditor independence?
14. Could ICT/COA have any impact on audit expectations gap?

APPENDIX D

Response from a “Big 4” firm

"Dear Kamil

As policy, ... supports research that is sponsored by professional bodies or regulators or other authorities. We receive many requests for support for other research projects but we regret that the pressures on our people's time is such that we are unable to respond to all such requests. I sent you a considered ..... response believing that would be sufficient and because I wanted to be helpful. I cannot approve you contacting other individuals within the firm nor am I prepared to arrange further interviews unless you can satisfy the conditions above. I regret this as your project is interesting but because of other demands on our scarce resources we have to set policies and apply them.

Good luck with the rest of your research.

.....

National Audit and ..... Partner"

APPENDIX E

Frequency Tables for Every Question in the Questionnaire

HOW TO COMPLETE THE QUESTIONNAIRE

1. The questionnaire is to be completed by audit staff.
2. Most of the questions require you to **TICK ONE BOX OR CELL ONLY** for each question.
3. In some questions, where boxes or cells are not provided, please supply your responses in the spaces provided in order of priority.
4. Some questions might not be applicable to auditors working in certain organisations, kindly write Not Applicable (N/A) in front of such questions.
5. Kindly check that you have not overlooked any of the questions.

Serial No.....

ABOUT ME

A1. Name of organisation.....

A2. Type of business

W:	1 Accounting firm	2 Manufacturing	3 Service oriented	4 Public sector	5 Selling & Distribution	
F:	41	7	5	20	0	= 73
WS (W*F):	41	14	15	80	0	= 150
F (%):	56.2	9.6	6.8	27.4	0	= 100

WAS: 150/73 = 2.05

A3. Department .....

A4. Section/Unit .....

A5. Current Position.....

A6. Qualification(s) (Tick as many boxes as are applicable)

W:	1 HND/BA/BSc	2 MA/MSc/MBA	3 PIIA/MIIA/QiCA	4 ACA/ACCA/CPFA	5 Others
F:	23	2	3	38	4 = 70
WS (W*F):	23	4	9	152	20 = 208
F (%):	32.9	2.9	4.3	54.3	5.7 = 100

WAS: 208/70 = 2.97

A7. Gender

W:	1 Male	2 Female	
F:	51	22	= 73
WS (W*F):	51	44	= 95
F (%):	69.91	30.1	= 100

WAS: 95/73 = 1.3

A8. Age

W:	1 18 - 24 yrs	2 25 - 34 yrs	3 35 - 44 yrs	4 45 - 54 yrs	5 55 yrs & above
F:	7	33	23	9	1 = 73
WS (W*F):	7	66	69	36	5 = 185
F (%)	9.6	45.2	31.5	12.3	1.4 = 100

WAS: 185/73 = 2.53

A9. Work experience

W:	1 1 - 5 yrs	2 6 - 10 yrs	3 11 - 15 yrs	4 16 - 20 yrs	5 21 yrs & above
F:	25	12	15	9	12 = 73
WS (W*F):	25	24	45	36	60 = 190
F (%):	34.2	16.4	20.5	12.3	16.4 = 100

WAS: 190/73 = 2.60

A10. I have been employed in my current position for.....

W:	1 Less than 1 yr	2 1-3 yrs	3 4- 6 yrs	4 7-9 yrs	5 10 yrs & above
F:	15	33	15	7	4 = 74
WS (W*F):	15	66	45	28	40 = 174
F (%):	20.3	44.6	20.3	9.5	5.4 = 100

WAS: 174/74 = 2.35

MY JOB AND INFORMATION & COMMUNICATIONS TECHNOLOGY (ICT)

[For the purpose of this study, ICT is considered to include the use of systems among which are computers, microelectronics and telecommunications for storing, retrieving, sorting, analysing and transferring information. Its adoption ranges from the use of computer hardware and software, data telecommunication and internet to the use of neural networks and artificial intelligence for planning, controlling, recording and reporting audit tasks]

B1. I rate my ICT skill as being.....

W:	5 Very Good	4 Good	3 Adequate	2 Basic	1 Very Basic
F:	14	27	19	9	4 = 73
WS (W*F):	70	108	57	18	4 = 257
F (%):	19.2	37.0	26.0	12.3	5.5 = 100

WAS: 257/73 = 3.52

B2. The type of access I have to a computer system for my official tasks is.....

W:	5 A laptop	4 A PC	3 Sharing a PC with others	2 A single PC for my entire unit	1 No PC at all
F:	56	14	2	1	0 = 73
WS (W*F):	280	56	6	2	0 = 344
F (%):	76.7	19.2	2.7	1.4	0 = 100

WAS: 344/73 = 4.71

B3. I have access to internet facilities (web browser) for my audit tasks.

W:	3 Always	2 Sometimes	1 Never	
F:	54	18	2	= 74
WS (W*F):	162	36	2	= 200
F (%):	73.0	24.3	2.7	= 100
WAS:	**200/74 = 2.70**			

B4. My organisation makes provision for the use of a mobile telephone for my audit assignments.

W:	3 Always	2 Sometimes	1 Never	
F:	40	16	18	= 74
WS (W*F):	120	32	18	= 170
F (%):	54.1	21.6	24.3	= 100
WAS:	**170/74 = 2.30**			

	W:	4 Always	3 Usually	2 Some-times	1 Never	WAS
B5	I use ICT tools and techniques in the planning of my audit assignments	46 (63.9%)	20 (27.8%)	5 (6.9%)	1 (1.4%)	255/72 = 3.54
B6	I use ICT tools and techniques in the recording of my audit tasks	47 (66.2%)	19 (26.8%)	5 (7.0%)	0 (0%)	255/71 = 3.59
B7	I use ICT tools and techniques in the data analysis of my audit tasks	52 (72.2%)	12 (16.7%)	8 (11.1%)	0 (0%)	260/72 = 3.61
B8	I use ICT tools and techniques in the controlling of my audit tasks	38 (52.8%)	22 (30.5%)	10 (13.9%)	2 (2.8%)	240/72 = 3.33
B9	I use ICT tools and techniques in the reporting of my audit tasks	51 (71.8%)	19 (26.8%)	1 (1.4%)	0 (0%)	263/71 = 3.70
B10	I use ICT tools and techniques in the internal communications within my firm/department	38 (53.5%)	24 (33.8%)	7 (9.9%)	2 (2.8%)	240/71 = 3.38

B11. The following are the aspects of my audit tasks in which I find ICT most useful (in order of aggregate respondents' preference):

i. Data Analysis and Interrogation
ii. Reporting
iii. Planning
iv. Communicating
v. Recording and Documenting
vi. Preparing Financial Statements and Verifying

Ledgers

vii. Controlling

viii. Analytical Review

ix. Researching Clients

x. Assessing Risk

xi. Verifying Processing Logic

xii. Storing Data

xiii. Illustrating Findings and Presentations

xiv. Standard Schedules

xv. Managing

xvi. Monitoring

xvii. Electronic Disclosure Checklists

xviii. Sample Selection

xix. Reviewing the Work of Others

xx. Tracking Audit

Recommendations/Follow Up

xxi. Testing

B12. The following are the aspects of my audit tasks in which I find ICT least useful (in order of aggregate respondents' preference):

i. Interfacing with clients (meetings, interviews etc.)

ii. Administrative tasks and managing staff

iii. Physical verifications (invoices, vouchers and stubs)

iv. Expressing opinions

v. Assessing risk

vi. Analysing control systems

vii. Cross referencing between working papers

viii. Planning

ix. Controlling

x. Substantive testing

xi. Review of paper files

xii. Detection of fraud and money laundering

	W:	5 Strongly Agree	4 Agree	3 Neither Agree Nor Disagree	2 Disagree	1 Strongly Disagree	WAS
B13	I'm satisfied with my organisation's provision of appropriate knowledge-based expert systems (e.g. audit enquiry programs) for my audit tasks	11 (15.1%)	45 (61.6%)	13 (17.8%)	3 (4.1%)	1 (1.4%)	281/7 = 3.85
B14	I'm satisfied with my organisation's provision of appropriate decision aids (e.g. neural networks) for my audit tasks	9 (12.7%)	31 (43.6%)	22 (31.0%)	9 (12.7%)	0 (0%)	253/71 = 3.56
B15	I'm satisfied with my organisation's provision of appropriate general ICT packages for my use.	16 (22.5%)	40 (56.4)	11 (15.5%)	4 (5.6%)	0 (0%)	281/71 = 3.96

B16. The following are the packages currently provided by my organisation for audit purposes (in order of aggregate respondents' preference):

i. IDEA
ii. AS/2
iii. Galileo
iv. Win EWP
v. Gemini caseware/caseview
vi. Bespoke software system
vii. Panaudit
viii. Proprietary software packages developed by the 'big4'
ix. Microsoft Office applications

	W:	5 Strongly Agree	4 Agree	3 Neither Agree Nor Disagree	2 Disagree	1 Strongly Disagree	WAS
B17	I'm satisfied with my organisation's provision of appropriate ICT training for me as an auditor	11 (15.3%)	45 (62.5%)	6 (8.3%)	9 (12.5%)	1 (1.4%)	272/72 = 3.78
B18	ICT is a major aspect of my mandatory continuous professional education	19 (26.4%)	28 (38.9%)	16 (22.2%)	9 (12.5%)	0 (0%)	273/72 = 3.79
B19	The use of ICT tools and techniques for my audit tasks gives me an advantage over my colleagues who use ICT less in other establishments	23 (32.4%)	31 (43.7%)	15 (21.1%)	2 (2.8%)	0 (0%)	288/71 = 4.06
B20	My client's size determines the level of automation I utilise for an audit assignment	10 (14.3)	31 (44.3%)	13 (18.6%)	16 (22.8%)	0 (0%)	245/70 = 3.50

	W:	5 Strongly Agree	4 Agree	3 Neither Agree Nor Disagree	2 Disagree	1 Strongly Disagree	WAS
B13	I'm satisfied with my organisation's provision of appropriate knowledge-based expert systems (e.g. audit enquiry programs) for my audit tasks	11 (15.1%)	45 (61.6%)	13 (17.8%)	3 (4.1%)	1 (1.4%)	281/73 = 3.85
B14	I'm satisfied with my organisation's provision of appropriate decision aids (e.g. neural networks) for my audit tasks	9 (12.7%)	31 (43.6%)	22 (31.0%)	9 (12.7%)	0 (0%)	253/71 = 3.56
B15	I'm satisfied with my organisation's provision of appropriate general ICT packages for my use.	16 (22.5%)	40 (56.4)	11 (15.5%)	4 (5.6%)	0 (0%)	281/71 = 3.96

B16. The following are the packages currently provided by my organisation for audit purposes (in order of aggregate respondents' preference):

i. IDEA
ii. AS/2
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vii. Panaudit
viii. Proprietary software packages developed by the 'big4'
ix. Microsoft Office applications

	W:	5 Strongly Agree	4 Agree	3 Neither Agree Nor Disagree	2 Disagree	1 Strongly Disagree	WAS
B17	I'm satisfied with my organisation's provision of appropriate ICT training for me as an auditor	11 (15.3%)	45 (62.5%)	6 (8.3%)	9 (12.5%)	1 (1.4%)	272/72 = 3.78
B18	ICT is a major aspect of my mandatory continuous professional education	19 (26.4%)	28 (38.9%)	16 (22.2%)	9 (12.5%)	0 (0%)	273/72 = 3.79
B19	The use of ICT tools and techniques for my audit tasks gives me an advantage over my colleagues who use ICT less in other establishments	23 (32.4%)	31 (43.7%)	15 (21.1%)	2 (2.8%)	0 (0%)	288/71 = 4.06
B20	My client's size determines the level of automation I utilise for an audit assignment	10 (14.3)	31 (44.3%)	13 (18.6%)	16 (22.8%)	0 (0%)	245/70 = 3.50

	W:	5 Strongly Agree	4 Agree	3 Neither Agree Nor Disagree	2 Disagree	1 Strongly Disagree	WAS
B21	The size of my organisation determines the level of automation I utilise for an audit assignment	0 (0%)	27 (41.5%)	20 (30.8%)	15 (23.1%)	3 (4.6%)	201/65 = 3.09
B22	The industry in which my client operates determines the level of automation I utilise for an audit assignment	9 (13.2%)	15 (22.1%)	20 (29.4%)	18 (26.5%)	6 (8.8%)	207/68 = 3.04
B23	The industry in which my organisation operates determines the level of automation I utilise for my audit assignment	6 (8.6%)	16 (22.9%)	21 (30.0%)	22 (31.4%)	5 (7.1%)	206/70 = 2.94
B24	I use more ICT tools and techniques for complex audit tasks than I do for simple audit tasks	5 (7.3%)	33 (47.8%)	14 (20.3%)	14 (20.3%)	3 (4.3%)	230/69 = 3.33
B25	I use more ICT tools and techniques for simple audit tasks than I do for complex audit tasks	2 (2.8%)	10 (14.1%)	21 (29.6%)	34 (47.9%)	4 (5.6%)	185/71 = 2.61
B26	The use of ICT tools and techniques for my audit is unavoidable	23 (31.9%)	37 (51.4%)	7 (9.7%)	4 (5.6%)	1 (1.4%)	293/72 = 4.07

	W:	5 Greatly Increases	4 Increases	3 Neither Increases Nor Decreases	2 Decreases	1 Greatly ecreases	WAS
B27	The use of ICT tools and techniques .....the quality of my audit tasks	26 (36.1%)	42 (58.3%)	4 (5.6%)	0 (0%)	0 (0%)	310/72 = 4.31
B28	The use of ICT tools and techniques ..... the cost of my audit tasks	1 (1.4%)	15 (20.8%)	22 (30.6%)	29 (40.3%)	5 (6.9%)	194/72 = 2.69
B29	The use of ICT tools and techniques ..... the possibility of incorrect audit opinions on my audit assignments	2 (2.8%)	3 (4.2%)	35 (49.3%)	25 (35.2%)	6 (8.5%)	183/71 = 2.58

B30. For my audit assignments, I utilise.....

W:	3 More ICT Techniques Than Manual Techniques	2 More Manual Techniques Than ICT Techniques	1 Equal Proportion of ICT Manual Techniques	
F:	47	8	17	= 72
WS (W*F):	141	16	17	= 174
F (%):	65.3	11.1	23.6	= 100
WAS:	174/72 = 2.42			

B31. The following are the factors I consider to be the major drawbacks of using ICT in audit tasks (in order of aggregate respondents' preference):

i. Inadequate training and skill
ii. System reliability and network failure (Loss of vital data)
iii. Different format of data by clients
iv. Cost (purchase, installation, maintenance, training etc.)
v. ICT dynamics and keeping pace with trends
vi. Excessive reliance
vii. Encouraging process auditing rather than holistic approach (hiding behind data)
viii. Human errors in input
ix. Auditors' attitude towards change
x. Clients' inadequate level of computerization
xi. Could over-emphasise form filling rather than judgement
xii. Inadequate infrastructure to support ICT
xiii. Health hazards
xiv. Lack of personalization

B32. The following are the factors I consider to be the major advantages of using ICT in audit tasks (in order of aggregate respondents' preference):
:

i. Time saving/speed (avoids repetitive tasks & duplications)
ii. accuracy
iii. adequacy of documentation (Storage and retrieval of data)
iv. consistency and standardisation
v. Better quality working papers and other outputs (neatness, clarity and service delivery)
vi. possibility of timely identifications of errors,
vii. Makes communication easier
viii. Differentiation from competition
ix. thoroughness
x. reliability
xi. ease of linking current to the previous year's work

B33. The following are the <u>potential</u> ways in which ICT can benefit the audit process (in order of aggregate respondents' preference):

i. Remote auditing (enterprise wide testing from one location)
ii. Increased availability of artificial intelligence systems for risk assessment
iii. Packages to interrogate the client's system
iv. Continuous improvement of the existing packages via research
v. Online auditing and control facilities

MY ORGANISATION AND ICT

	W:	5 Strongly Agree	4 Agree	3 Neither Agree Nor Disagree	2 Disagree	1 Strongly Disagree	WAS
C1	My firm's web site helps my audit tasks significantly	9 (12.5%)	25 (34.7%)	20 (27.8%)	14 (19.4%)	4 (5.6%)	237/72 = 3.29
C2	My firm's web site does not help my audit tasks significantly	4 (5.6%)	17 (23.6%)	15 (20.8%)	24 (33.3%)	12 (16.7%)	193/72 = 2.68
C3	My access to internet facilities helps my audit tasks considerably	16 (22.5%)	45 (63.4%)	8 (11.3%)	1 (1.4%)	1 (1.4%)	287/71 = 4.04
C4	I think my organisation's investment in ICT is justified given its level of performance	20 (28.6%)	33 (47.1%)	13 (18.6%)	3 (4.3%)	1 (1.4%)	278/70 = 3.97
C5	I think such investment in ICT is justified given my organisation's level of client/customer retention	14 (20.3%)	33 (47.8%)	20 (29.0%)	1 (1.4%)	1 (1.4%)	265/69 = 3.84
C6	I think such investment in ICT is justified given my organisation's size/level of expansion	16 (22.2%)	43 (59.7%)	12 (16.7%)	1 (1.4%)	0 (0%)	290/72 = 4.03
C7	My firm/department has its own (in-house) designed audit packages	17 (24.6%)	28 (40.6%)	1 (1.4%)	17 (24.6%)	6 (8.7%)	240/69 = 3.48
C8	The use of ICT tools and techniques has led to certain forms of changes in my organisation's structure	9 (12.9%)	33 (47.1%)	17 (24.3%)	10 (14.3%)	1 (1.4%)	249/70 = 3.56
C9	The implementation of ICT has led to power shift (political) within my firm/department	4 (5.7%)	11 (15.7%)	33 (47.2%)	18 (25.7%)	4 (5.7%)	203/70 = 2.90
C10	My organisation's utilisation of ICT tools and techniques has improved its business relations with its shareholders/partners	9 (12.9%)	24 (34.3%)	31 (44.3%)	5 (7.1%)	1 (1.4%)	245/70 = 3.50
C11	My organisation's utilisation of ICT tools and techniques has improved its business relations with its customers/clients	12 (16.9%)	44 (62.0%)	13 (18.3%)	1 (1.4%)	1 (1.4%)	277/71 = 3.90
C12	The use of ICT tools and techniques has enhanced my working relationship with my superiors within the context of my official duties	9 (13.0%)	36 (52.2%)	20 (29.0%)	4 (5.8%)	0 (0%)	257/69 = 3.72
C13	The use of ICT tools and techniques has enhanced my working relationship with my subordinates within the context of my official duties	8 (11.4%)	39 (55.7%)	19 (27.1%)	4 (5.7%)	0 (0%)	261/70 = 3.73

	W:	5 Strongly Agree	4 Agree	3 Neither Agree Nor Disagree	2 Disagree	1 Strongly Disagree	WAS
C14	The use of ICT tools and techniques has enhanced my working relationship with my colleagues within the context of my official duties	9 (12.8%)	37 (52.9%)	20 (28.6%)	4 (5.7%)	0 (0%)	261/70 = 3.73
C15	The use of ICT tools and techniques has enhanced my working relationship with the management within the context of my official duties	9 (12.9%)	36 (51.4%)	20 (28.6%)	5 (7.1%)	0 (0%)	254/70 = 3.63
C16	The refusal of an audit firm to use ICT tools and techniques could lead to low quality audit	17 (24.3%)	34 (48.6%)	12 (17.1%)	7 (10.0%)	0 (0%)	271/70 = 3.87
C17	The use of ICT tools and techniques has made my performance more satisfactory to me as an auditor	19 (26.8%)	44 (62.0%)	6 (8.5%)	2 (2.8%)	0 (0%)	293/71 = 4.13
C18	The use of ICT tools and techniques has enhanced my commitment to my organisation's goals	9 (12.7%)	29 (40.8%)	26 (36.6%)	7 (9.9%)	0 (0%)	253/71 = 3.56
C19	The increasing adoption of ICT in the audit process has aided my professional career development	14 (20.3%)	36 (52.2%)	14 (20.3%)	5 (7.2%)	0 (0%)	262/69 = 3.86
C20	The use of ICT for audit tasks by my organisation gives it a comparative advantage over its competitors who don't use ICT	18 (26.9%)	37 (55.2%)	10 (14.9%)	2 (3.0%)	0 (0%)	272/67 = 4.06
C21	The increase in the adoption of ICT has created a number of job opportunities for specialist auditors in my firm/department	14 (20.3%)	32 (46.4%)	15 (21.7%)	8 (11.6%)	0 (0%)	259/69 = 3.75
C22	The consideration of an employee's ICT skills constitutes a major criterion for recruiting new auditors in my firm/department	8 (11.6%)	24 (34.8%)	26 (37.7%)	11 (15.9%)	0 (0%)	236/69 = 3.42
C23	The increasing adoption of ICT in the audit process has led to high labour turnover in my organisation	4 (5.7%)	7 (10%)	18 (25.7%)	36 (51.4%)	5 (7.1%)	179/70 = 2.56
C24	ICT tools and techniques are important instruments for risk assessment	12 (17.1%)	42 (60.0%)	12 (17.1%)	4 (5.7%)	0 (0%)	272/70 = 3.89
C25	ICT tools and techniques are important instruments for strengthening business and accounting systems	15 (21.7%)	50 (72.5%)	4 (5.8%)	0 (0%)	0 (0%)	289/69 = 4.19

C34. The use of ICT ..... the audit fees.

W:	5 Greatly Increases	4 Increases	3 Neither Increases Nor Reduces	2 Reduces	1 Greatly Reduces
F:	3	12	42	7	0 = 64
WS (W*F):	15	48	126	14	0 =203
F (%):	4.7	18.8	65.6	10.9	0 =100

WAS: 203/64 = 3.17

C35. The use of ICT tools and techniques has ..... the number of non-professional (administrative) staff in my firm/department

W:	5 Greatly Increased	4 Increased	3 Neither Increased Nor Reduced	2 Reduced	1 Greatly Reduced
F:	0	5	35	24	1 = 65
WS (W*F):	0	20	105	48	1 =174
F (%):	0	7.7	53.9	36.9	1.5 =100

WAS: 174/65 = 2.68

C36. The use of ICT tools and techniques has ..... the number of professional staff in my firm/department

W:	5 Greatly Increased	4 Increased	3 Neither Increased Nor Reduced	2 Reduced	1 Greatly Reduced
F:	0	14	42	6	0 = 62
WS (W*F):	0	56	126	12	0 =194
F (%):	0	22.6	67.7	9.7	0 =100

WAS: 194/62 = 3.13

C37. On an average, my firm/department upgrades existing audit packages ones every.....

W:	7 Six months	6 One year	5 Two years	4 Three years	3 Four years	2 Five years	1 Others
F:	5	15	14	8	4	3	0 = 49
WS (W*F):	35	90	70	32	12	6	0 = 210
F (%):	10.2	30.6	28.6	16.3	8.2	6.1	0 = 100
WAS:	**210/49 = 4.29**						

C38. On an average, my firm/department upgrades existing audit packages ones every.....

W:	7 Six months	6 One year	5 Two years	4 Three years	3 Four year	2 Five years	1 Others
F:	0	2	12	10	7	13	0 = 44
WS (W*F):	0	12	60	40	21	26	0 = 159
F (%):	0	4.5	27.3	22.7	15.9	29.5	= 100
WAS:	**159/44 = 3.61**						

C39. The use of ICT tools and techniques sometimes affects my attitude to work within the context of my professional performance.....

W:	3 Negatively	2 Positively	1 Neither Negatively Nor Positively	
F:	4	36	23	= 63
WS (W*F):	12	72	23	= 107
F (%):	6.3	57.1	36.5	= 100
WAS:	**107/63 = 1.70**			

CONTINUOUS ONLINE AUDITING (COA)

[Otherwise referred to as real-time or concurrent auditing, Continuous Online Auditing (COA) is a comprehensive electronic process that enables auditors to provide some degree of assurance on continuous information simultaneously with, or very shortly after, the disclosure of the information, achieving these through Real Time Accounting (RTA) systems. The concept has been made feasible with the developments in digital telecommunications. Its key constituents are continuous audit of database applications, data capture procedures, systems audit and real time analytical procedures. COA can lead to the issuance of audit reports on a short interval basis (daily, weekly or as immediately as feasible).

COA can be useful as a modern auditing technique in two ways. It has both detective orientation (ex-post) and preventive orientation (ex-ante). The first orientation serves a similar purpose with the traditional audit of examining 'historical' records and books of accounts to derive audit evidence, whereas the latter could serve as a barrier to the occurrence of errors and frauds with the use of sophisticated ICT tools and techniques. These can be greatly enhanced through the design and use of appropriate artificial intelligence to function as Continuous Intelligent Online Validation]

	W:	5 Strongly Agree	4 Disagree	3 Neither Agree Nor Disagree	2 Disagree	1 Strongly Disagree	WAS
D1	COA could help me in fraud prevention	5 (8.6%)	34 (58.6%)	15 (25.9%)	4 (6.9%)	0 (0%)	214/58 = 3.69
D2	COA could help me in fraud detection	6 (10.3%)	40 (69.0%)	11 (19.0%)	1 (1.7%)	0 (0%)	225/58 = 3.88
D3	COA could help me in fraud investigation	7 (12.1%)	37 (63.8%)	13 (22.4%)	1 (1.7%)	0 (0%)	224/58 = 3.86
D4	COA could enhance the decision usefulness of financial information to the shareholders/partners in my organisation	9 (15.5%)	27 (46.5%)	19 (32.2%)	3 (5.2%)	0 (0%)	216/58 = 3.72
D5	COA could enhance the decision usefulness of financial information to the investment analysts	5 (9.1%)	23 (41.8%)	24 (43.6%)	3 (5.5%)	0 (0%)	195/55 = 3.55
D6	COA could enhance the decision usefulness of financial information to prospective investors	5 9.4(%)	21 (39.6%)	24 (45.3%)	3 (5.7%)	0 (0%)	187/53 = 3.53
D7	COA could enhance the decision usefulness of financial information to the tax authorities	5 (8.9%)	26 (46.4%)	22 (39.3%)	3 (5.4%)	0 (0%)	201/56 = 3.59
D8	COA could enhance the decision usefulness of financial information to the employees of my organisation	3 (5.4%)	25 (45.5%)	23 (41.8%)	4 (7.3%)	0 (0%)	192/55 = 3.49
D9	COA could enhance the decision usefulness of financial information to the general public	3 (5.3%)	27 (47.4%)	24 (42.0%)	3 (5.3%)	0 (0%)	201/57 = 3.53

D10. The following are the possible ways in which COA could enhance audit effectiveness (in order of aggregate respondents' preference):

i. Quick discovery & investigation of errors and fraud
ii. Reduction of post year end intensive work level
iii. Time saving
iv. Adequacy, sufficiency & reliability of audit evidence
v. Timely feedback to clients and other users
vi. Assurance of data accuracy
vii. Instant capture of transactions and control breaches
viii. Makes review easier

D11. The following are the possible ways COA could jeopardise audit effectiveness effectiveness (in order of aggregate respondents' preference):

i. Overreliance on COA at the expense of other assessment
ii. Might take away the element of judgement
iii. Down time or system bug
iv. May be too intrusive/clients' employees might be uncomfortable
v. Might increase fraud if clients know the system
vi. Incorrect set up
vii. Reduces human contact
viii. Audit report might lose importance and effectiveness
ix. Might limit analyses and comparisons

ICT AND AUDITOR INDEPENDENCE

	W:	5 Strongly Agree	4 Agree	3 Neither Agree Nor Disagree	2 Disagree	1 Strongly Disagree	WAS
E1	Auditors rely too heavily on their clients' information systems for their audit	7 (10.4%)	22 (32.8%)	23 (34.3%)	15 (22.4%)	0 (0%)	222/67 = 3.31
E2	An auditor will compromise his/her independence by placing software agents/routines in a client's system and relying on them for audit judgement	1 (1.5%)	13 (19.4%)	26 (38.8%)	25 (37.3%)	2 (3.0%)	187/67 = 2.79
E3	Audit firms are quite often involved in the computerisation of their clients' accounting information systems	1 (1.5%)	30 (45.5%)	21 (31.8%)	12 (18.2%)	2 (3.0%)	214/66 = 3.24

	W:	5 Greatly Enhances	4 Enhances	3 Neither Enhances Nor Inhibits	2 Inhibits	1 Greatly Inhibits	WAS
E4	Generally, audit automation ..... auditor independence	2 (2.8%)	30 (42.3%)	37 (52.1%)	2 (2.8%)	0 (0%)	245/71 =3.45
E5	The use of ICT tools and techniques ..... my professional competence	7 (9.7%)	46 (63.9%)	18 (25.0%)	1 (1.4%)	0 (0%)	275/72 = 3.82
E6	The use of ICT tools and techniques ..... the scope of my professional expertise	9 (12.5%)	37 (51.4%)	25 (34.7%)	1 (1.4%)	0 (0%)	270/72 = 3.75
E7	The use of ICT tools and techniques..... my fairness and sense of justice in forming my audit opinions	5 (7.0%)	27 (38.0%)	39 (54.9%)	0 (0%)	0 (0%)	250/71 = 3.52

E8. COA could make auditors..... of/on their clients.

W:	5 Greatly Independent	4 Independent	3 Neither Dependent Nor Independent	2 Dependent	1 Greatly Dependent
F:	2	11	43	8	0 = 64
WS (W*F):	10	44	129	16	0 = 199
F (%):	3.1	17.2	67.2	12.5	0 = 100

WAS: 199/64 = 3.11

E9. The following are the ways I think the use of ICT could jeopardise auditor independence effectiveness (in order of aggregate respondents' preference):

i. Overreliance on clients IS/IT system
ii. Auditors' involvement in developing controls
iii. Lack of audit trail
iv. Audit programs substantially known to clients
v. Relying on clients IT experts for data extraction
vi. Information sharing between clients and auditors

E10. The following are the ways I think the use of ICT could enhance auditor independence effectiveness (in order of aggregate respondents' preference):

i. Freedom to access more data

ii. Own audit trail in the client system

iii. Less contact because of remote access to information

iv. Creates room for considering other risk areas

v. Bias and subjectivity is reduced in sampling

vi. Standardisation of coverage by all auditors

vii. Better efficiency

ICT AND AUDIT EXPECTATIONS-PERFORMANCE GAP

[The audit expectations gap involves the perception gap between the views of the users of audited financial statements as well as the wider society concerning what auditors are expected to do and what auditors believe are their main duties and responsibilities]

	W:	5 Strongly Agree	4 Agree	3 Neither Agree Nor Disagree	2 Disagree	1 Strongly Disagree	WAS
F1	The increase in the use of ICT by auditors has led to appropriate and relevant auditing standards being issued by the regulatory authorities	2 (2.9%)	23 (33.8%)	34 (50.0%)	9 (13.2%)	0 (0%)	222/68 = 3.26
F2	The increase in the use of ICT by auditors has led to sufficient auditing standards being issued by the regulatory authorities	1 (1.5%)	20 (30.8%)	34 (52.3%)	10 (15.4%)	0 (0%)	207/65 = 3.18
F3	The use of ICT has enhanced the understanding of financial statements' users with regards to the distinction between the responsibilities of the auditor and those of an entity's management	0 (0%)	13 (20.3%)	34 (53.1%)	15 (23.4%)	2 (3.1%)	186/64 = 2.91
F4	Shareholders might to have increased confidence in audited financial statements if they were aware of the auditor's use of ICT tools and techniques	0 (0%)	27 (41.5%)	26 (40.0%)	12 (18.5%)	0 (0%)	234/65 = 3.60
F5	Other interested parties might have increased confidence in audited financial statements if they were aware of the auditor's use of ICT tools and techniques	0 (0%)	27 (41.5%)	27 (41.5%)	11 (16.9%)	0 (0%)	211/65 = 3.25

F6. Users of audited financial statements are likely to ..... the effectiveness ICT could bring to audit.

W:	5 Greatly Over-estimate	4 Over-estimate	3 Neither Over-estimate Nor Under-estimate	2 Under-estimate	1 Highly Under-estimate
F:	1	26	29	10	0 = 66
WS (W*F):	5	104	87	20	0 = 216
F (%):	1.5	39.4	43.9	15.2	0 = 100

WAS: 216/66 = 3.27

F7. COA could ..... the audit expectations gap.

	5 Greatly Increase	4 Increase	3 Neither Increases Nor Decrease	2 Decrease	1 Greatly Decrease
F:	0	19	29	16	0 = 64
WS (W*F):	0	76	87	32	0 = 195
F (%):	0	29.7	45.3	25.0	0 = 100

WAS: 195/64 = 3.05

F8. The following are the ways I think ICT could reduce the audit expectations gap effectiveness (in order of aggregate respondents' preference):

i. Users' awareness of ICT weaknesses via ICT-based educational media
ii. Increased accuracy and validity
iii. Notes in the financial statements on the ICT impact on audit
iv. Standardisation of processes
v. Increase in the level of testing
vi. Public access to information about audit function via ICT
vii. COA may increase shareholders' confidence
viii. ICT alone can't do this

F9. The following are the ways I think ICT could increase the audit expectations gap effectiveness (in order of aggregate respondents' preference):

i. Thinking all errors and fraud will be identified (sampling and materiality may not permit this)
ii. Blaming misstatement on ICT
iii. Ascribing too much powers to IT (infallibility and perfect results)

COMMENTS AND SUGGESTIONS

i. Audit cannot be entirely an automated process because there are lots of areas that require human judgements
ii. The research is a unique one. The results will be of great importance to auditors as it will improve the quality of their work. I hope the results are published for auditors' benefits
iii. The questionnaire is too detailed for a good response rate

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Thank you for completing this questionnaire. Kindly return it in the prepaid envelope provided by Friday, 26th March, 2004.

If you would like to be contacted on a strictly confidential basis, either write your name, E-mail address and telephone number below or contact the author.

Name..... E-mail.....

Address.....Telephone number (Daytime).....

Appendix F

Additional Crosstabulations

Crosstabulations

B30 * B5		B5: I use ICT tools and techniques in the planning of my audit tasks				Total
		Never	Sometimes	Usually	Always	
B30: I utilise ..... for my audit assignments	Equal Proportion of ICT and Manual Techniques	1	2	4	10	17
	More Manual Techniques Than ICT Techniques	0	1	4	3	8
	More ICT Techniques Than Manual Techniques	0	2	12	33	47
Total		1	5	20	46	72

Table F1

Crosstabulations

B30 * B6		B6: I use ICT tools and techniques in the recording of my audit tasks			Total
		Sometimes	Usually	Always	
B30: I utilise ..... for my audit assignments	Equal Proportion of ICT and Manual Techniques	2	4	10	16
	More Manual Techniques Than ICT Techniques	1	4	3	8
	More ICT Techniques Than Manual Techniques	2	11	34	47
Total		5	19	47	71

Table F2

Crosstabulations

B30 * B7		B7: I use ICT tools and techniques in the data analysis of my audit tasks			Total
		Sometimes	Usually	Always	
B30: I utilise ..... for my audit assignments	Equal Proportion of ICT and Manual Techniques	4	3	10	17
	More Manual Techniques Than ICT Techniques	3	1	4	8
	More ICT Techniques Than Manual Techniques	1	8	38	47
Total		8	12	52	72

Table F3

Crosstabulations

B30 * B8		B8: I use ICT tools and techniques in the controlling of my audit tasks				Total
		Never	Sometimes	Usually	Always	
B30: I utilise ..... for my audit assignments	Equal Proportion of ICT and Manual Techniques	1	5	4	7	17
	More Manual Techniques Than ICT Techniques	1	2	1	4	8
	More ICT Techniques Than Manual Techniques	0	3	17	27	47
Total		2	10	22	38	72

Table F4

Crosstabulations

B30 * B9		B9: I use ICT tools and techniques in the reporting of my audit tasks			Total
		Sometimes	Usually	Always	
B30: I utilise ..... for my audit assignments	Equal Proportion of ICT and Manual Techniques	1	7	9	17
	More Manual Techniques Than ICT Techniques	0	4	3	7
	More ICT Techniques Than Manual Techniques	0	8	39	47
Total		1	19	51	71

Table F5

Crosstabulations

B30 * B10		B10: I use ICT tools and techniques in the internal communications within my organisation				Total
		Never	Sometimes	Usually	Always	
B30: I utilise ..... for my audit assignments	Equal Proportion of ICT and Manual Techniques	0	2	5	10	17
	More Manual Techniques Than ICT Techniques	1	1	3	3	8
	More ICT Techniques Than Manual Techniques	1	4	16	25	46
Total		2	7	24	38	71

Table F6

Crosstabulations

B5 * A3		A3: Class of Auditor		Total
		External Auditors	Internal Auditors	
B5: I use ICT tools and techniques in the planning of my audit tasks	Never	0 (0.0%)	1 (3.3%)	1
	Sometimes	1 (2.4%)	4 (13.3%)	5
	Usually	12 (28.6%)	8 (26.7%)	20
	Always	29 (69.0%)	17 (56.7%)	46
Total		42 (100%)	30 (100%)	72

Table F7

Crosstabulations

B6 * A3		A3: Class of Auditor		Total
		External Auditors	Internal Auditors	
B6: I use ICT tools and techniques in the recording of my audit tasks	Sometimes	5 (11.9%)	0 (0.0%)	5
	Usually	9 (21.4%)	10 (34.5%)	19
	Always	28 (66.7%)	19 (65.5%)	47
Total		42 (100.0%)	29(100.0%)	71

Table F8

Crosstabulations

B7 * A3		A3: Class of Auditor		Total
		External Auditors	Internal Auditors	
B7: I use ICT tools and techniques in the data analysis of my audit tasks	Sometimes	3 (7.1%)	5 (16.7%)	8
	Usually	5 (11.9%)	7 (23.3%)	12
	Always	34 (81.0%)	18 (60.0%)	52
Total		42 (100.0%)	30 (100.0%)	72

Table F9

Crosstabulations

B8 * A3		A3: Class of Auditor		Total
		External Auditors	Internal Auditors	
B8: I use ICT tools and techniques in the controlling of my audit tasks	Never	0 (0.0%)	2 (6.7%)	2
	Sometimes	8 (19.0%)	2 (6.7%)	10
	Usually	13 (31.0%)	9 (30.0%)	22
	Always	21 (50.0%)	17 (56.6.0%)	38
Total		42 (100.0%)	30 (100.0%)	72

Table F10

Crosstabulations

B9 * A3		A3: Class of Auditor		Total
		External Auditors	Internal Auditors	
B9: I use ICT tools and techniques in the reporting of my audit tasks	Sometimes	0 (0.0%)	1 (3.3%)	1
	Usually	11 (26.8%)	8 (26.7%)	19
	Always	30 (73.2%)	21 (70.0%)	51
Total		41 (100.0%)	30 (100.0%)	71

Table F11

Crosstabulations

B10 * A3		A3: Class of Auditor		Total
		External Auditors	Internal Auditors	
B10: I use ICT tools and techniques in the internal communications within my organisation	Never	1 (2.4%)	1 (3.4%)	2
	Sometimes	3 (7.1%)	4 (13.8%)	7
	Usually	14 (33.3%)	10 (34.5%)	24
	Always	24 (57.2%)	14 (48.3%)	38
Total		42 (100.0%)	29 (100.0%)	71

Table F12

Crosstabulations

B5 * A8		A8: Age (in years)					Total
		18 - 24	25 - 34	35 - 44	45 - 54	55 and above	
B5: I use ICT tools and techniques in the planning of my audit tasks	Never	0	1	0	0	0	1
	Sometimes	0	3	1	1	0	5
	Usually	2	8	5	4	1	20
	Always	5	21	16	4	0	46
Total		7	33	22	9	1	72

Table F13

Crosstabulations

B6 * A8		A8: Age (in years)					Total
		18 - 24	25 - 34	35 - 44	45 - 54	55 and above	
B6: I use ICT tools and techniques in the recording of my audit tasks	Sometimes	1	3	0	1	0	5
	Usually	2	9	5	2	1	19
	Always	4	20	17	6	0	47
Total		7	32	22	9	1	71

Table F14

Crosstabulations

B7 * A8		A8: Age (in years)					Total
		18 - 24	25 - 34	35 - 44	45 - 54	55 and above	
B7: I use ICT tools and techniques in the data analysis of my audit tasks	Sometimes		4	1	2	1	8
	Usually	2	4	5	1	0	12
	Always	5	25	16	6	0	52
Total		7	33	22	9	1	72

Table F15

Crosstabulations

B8 * A8		A8: Age (in years)					Total
		18 - 24	25 - 34	35 - 44	45 - 54	55 and above	
B8: I use ICT tools and techniques in the controlling of my audit tasks	Never	0	2	0	0	0	2
	Sometimes	0	7	2	1	0	10
	Usually	4	9	8	1	0	22
	Always	3	15	12	7	1	38
Total		7	33	22	9	1	72

Table F16

Crosstabulations

B9 * A8		A8: Age (in years)					Total
		18 - 24	25 - 34	35 - 44	45 - 54	55 and above	
B9: I use ICT tools and techniques in the reporting of my audit tasks	Sometimes	0	1	0	0	0	1
	Usually	2	8	5	3	1	19
	Always	5	23	17	6	0	51
Total		7	32	22	9	1	71

Table F17

Crosstabulations

B10 * A8		A8: Age (in years)					Total
		18 - 24	25 - 34	35 - 44	45 - 54	55 and above	
B10: I use ICT tools and techniques in the in my internal communications within my organisation	Never	0	1	1	0	0	2
	Sometimes	1	0	5	1	0	7
	Usually	3	13	7	1	0	14
	Always	3	19	9	6	1	38
Total		7	33	22	8	1	71

Table F18

Crosstabulations

B5 * A9		A9: Work Experience (in years)					Total
		1 - 5	6 – 10	11- 15	16 - 20	21 and above	
B5: I use ICT tools and techniques in the planning of my audit tasks	Never	1	0	0	0	0	1
	Sometimes	2	1	0	1	1	5
	Usually	6	3	4	3	4	20
	Always	16	8	10	5	7	46
Total		25	12	14	9	12	72

Table F19

Crosstabulations

B6 * A9		A9: Work Experience (in years)					Total
		1 - 5	6 - 10	11- 15	16 - 20	21 and above	
B6: I use ICT tools and techniques in the recording of my audit tasks	Sometimes	1	3	0	0	1	5
	Usually	8	3	2	2	4	19
	Always	15	6	12	7	7	47
Total		24	12	14	9	12	71

Table F20

Crosstabulations

B7 * A9		A9: Work Experience (in years)					Total
		1 – 5	6 – 10	11- 15	16 – 20	21 and above	
B7: I use ICT tools and techniques in the data analysis of my audit tasks	Sometimes	1	3	0	2	2	8
	Usually	5	1	3	0	3	12
	Always	19	8	11	7	7	52
Total		25	12	14	9	12	72

Table F21

Crosstabulations

B8 * A9		A9: Work Experience (in years)					Total
		1 - 5	6 - 10	11- 15	16 - 20	21 and above	
B8: I use ICT tools and techniques in the controlling of my audit tasks	Never	1	1	0	0	0	2
	Sometimes	4	3	2	0	1	10
	Usually	9	3	4	3	3	22
	Always	11	5	8	6	8	38
Total		25	12	14	9	12	73

Table F22

Crosstabulations

B9 * A9		A9: Work Experience (in years)					Total
		1 - 5	6 - 10	11- 15	16 - 20	21 and above	
B9: I use ICT tools and techniques in the reporting of my audit tasks	Sometimes	1	0	0	0	0	1
	Usually	6	3	5	2	3	19
	Always	17	9	9	7	9	51
Total		24	12	14	9	12	71

Table F23

Crosstabulations

B10 * A9		A9: Work Experience (in years)					Total
		1 – 5	6 – 10	11- 15	16 – 20	21 and above	
B10: I use ICT tools and techniques in the internal communications within my organisation	Never	0	1	1	0	0	2
	Sometimes	1	0	1	2	3	7
	Usually	13	3	4	2	2	24
	Always	11	8	8	5	6	38
Total		25	12	14	9	11	71

Table F24

Crosstabulations

B5 * A7		A7: Gender		Total
		Male	Female	
B5: I use ICT tools and techniques in the planning of my audit tasks	Never	1 (2.0%)	0 (0.0%)	1
	Sometimes	3 (5.9%)	2 (9.5%)	5
	Usually	14 (27.4%)	6 (28.6%)	20
	Always	33 (64.7%)	13 (61.9%)	46
Total		51 (100.0%)	21 (100.0%)	72

Table F25

Crosstabulations

B6 * A7		A7: Gender		Total
		Male	Female	
B6: I use ICT tools and techniques in the recording of my audit tasks	Sometimes	3 (6.0%)	2 (9.5%)	5
	Usually	12 (24.0%)	7 (33.3)	19
	Always	35 (70.0%)	12 (57.2%)	47
Total		50 (100.0%)	21(100.0%)	71

Table F26

Crosstabulations

B7 * A7		A7: Gender		Total
		Male	Female	
B7: I use ICT tools and techniques in the data analysis of my audit tasks	Sometimes	6 (11.8%)	2 (9.5%)	8
	Usually	10 (19.6%)	2 (9.5%)	12
	Always	35 (68.6%)	17 (81.0%)	52
Total		51 (100.0%)	21 (100.0%)	72

Table F27

Crosstabulations

B8 * A7		A7: Gender		Total
		Male	Female	
B8: I use ICT tools and techniques in the controlling of my audit tasks	Never	2 (3.9%)	0 (0.0%)	2
	Sometimes	7 (13.7%)	3 (14.3%)	10
	Usually	15 (29.4%)	7 (33.3%)	22
	Always	27 (53.0%)	11 (52.4%)	38
Total		51 (100.0%)	21 (100.0%)	72

Table F28

Crosstabulations

B9 * A7		A7: Gender		Total
		Male	Female	
B9: I use ICT tools and techniques in the reporting of my audit tasks	Sometimes	1 (2.0%)	0 (0.0%)	1
	Usually	14 (27.5%)	5 (25.0%)	19
	Always	36 (70.5%)	15 (75.0%)	51
Total		51 (100.0%)	20 (100.0%)	71

Table F29

Crosstabulations

B10 * A7		A7: Gender		Total
		Male	Female	
B10: I use ICT tools and techniques in the internal communications within my organisation	Never	2 (4..0%)	0 (0.0%)	2
	Sometimes	5 (10.0%)	2 (9.5%)	7
	Usually	17 (34.0%)	7 (33.3%)	24
	Always	26 (52.0%)	12 (57.2%)	38
Total		50 (100.0%)	21 (100.0%)	71

Table F30

Crosstabulations

B30 * C30		C30: ICT makes it ..... to gather **sufficient** audit evidence				
		More Difficult	Neither Easier Nor More Difficult	Easier	Much Easier	Total
B30: I utilise ..... for my audit assignments	Equal Proportion of ICT and Manual Techniques	0	5	10	0	15
	More Manual Techniques Than ICT Techniques	1	2	5	0	8
	More ICT Techniques Than Manual Techniques	1	12	20	14	47
Total		2	19	35	14	70

Table F31

Crosstabulations

B30 * C31		C31: ICT makes it ..... to gather **reliable** audit evidence			Total
		Neither Easier Nor More Difficult	Easier	Much Easier	
B30: I utilise ..... for my audit assignments	Equal Proportion of ICT and Manual Techniques	6	9	0	15
	More Manual Techniques Than ICT Techniques	1	7	0	8
	More ICT Techniques Than Manual Techniques	17	17	13	47
Total		24	33	13	70

Table F32

Crosstabulations

B30 * C26		C26: ICT makes my audit tests easier to perform			Total
		Neither Agree Nor Disagree	Agree	Strongly Agree	
B30: I utilise ..... for my audit assignments	Equal Proportion of ICT and Manual Techniques	2	11	1	14
	More Manual Techniques Than ICT Techniques	0	7	1	8
	More ICT Techniques Than Manual Techniques	6	25	13	44
Total		8	43	15	66

Table F33

Crosstabulations

B30 * C32		C32: Audit trails are ..... to access in an entity with a computerised accounting system				Total
		More Difficult	Neither Easier Nor More Difficult	Easier	Much Easier	
B30: I utilise ..... for my audit assignments	Equal Proportion of ICT and Manual Techniques	0	0	12	3	15
	More Manual Techniques Than ICT Techniques	2	1	4	1	8
	More ICT Techniques Than Manual Techniques	7	9	14	16	46
Total		9	10	30	20	69

Table F34

Crosstabulations

B30 * B27		B27: ICT..... the quality of my audit			
		Neither Increases Nor Decreases	Increases	Greatly Increases	Total
B30: I utilise ..... for my audit assignments	Equal Proportion of ICT and Manual Techniques	1	13	3	17
	More Manual Techniques Than ICT Techniques	1	5	3	9
	More ICT Techniques Than Manual Techniques	2	24	20	46
Total		4	42	26	72

Table F35

Crosstabulations

C8 * A3		A3: Class of Auditor		Total
		External Auditors	Internal Auditors	
C8: ICT has led to certain forms of change in my organisation structure	Strongly Disagree	1	0	1
	Disagree	6	4	10
	Neither Agree Nor Disagree	9	7	16
	Agree	19	14	33
	Strongly Agree	6	3	9
Total		41	28	69

Table F36

Crosstabulations

C9 * A3		A3: Class of Auditor		Total
		External Auditors	Internal Auditors	
C9: ICT has led to political power shift within my organisation/department	Strongly Disagree	3	1	4
	Disagree	10	8	18
	Neither Agree Nor Disagree	20	13	33
	Agree	6	5	11
	Strongly Agree	3	1	4
Total		42	28	70

Table F37

Crosstabulations

C19 * A3		A3: Class of Auditor		Total
		External Auditor	Internal Auditor	
C19: ICT aids auditors' professional career development	Disagree	3	2	5
	Neither Agree Nor Disagree	5	10	15
	Agree	22	14	36
	Strongly Agree	12	2	14
Total		42	28	70

Table F38

Crosstabulations

C21 * A3		A3: Class of Auditor		Total
		External Auditor	Internal Auditor	
C21: ICT has created a number of job opportunities for specialist auditors in my organisation	Disagree	4	4	8
	Neither Agree Nor Disagree	7	9	16
	Agree	20	12	32
	Strongly Agree	11	3	14
Total		42	28	70

Table F39

Crosstabulations

C23 * A3		A3: Class of Auditor		Total
		External Auditor	Internal Auditor	
C23: ICT has led to high labour turnover in my organisation	Strongly Disagree	4	1	5
	Disagree	19	17	36
	Neither Agree Nor Disagree	11	7	18
	Agree	3	4	7
	Strongly Agree	4	0	4
Total		41	29	70

Table F40

Crosstabulations

C35 * A3		A3: Class of Auditor		Total
		External Auditor	Internal Auditor	
C35: ICT has ..... the number of non-professional (administrative) staff in my firm/department	Greatly Reduced	0	1	1
	Reduced	17	7	24
	Neither Increased Nor Reduced	21	15	36
	Increased	4	1	5
Total		42	24	66

Table F41

Crosstabulations

C36 * A3		A3: Class of Auditor		Total
		External Auditor	Internal Auditor	
C36: ICT has ..... the number of professional staff in my firm/department	Reduced	5	1	6
	Neither Increased Nor Reduced	23	20	43
	Increased	11	3	14
	Greatly Increased	1	1	2
Total		40	25	65

Table F42

Crosstabulations

C33 * A3		A3: Class of Auditor		Total
		External Auditors	Internal Auditors	
C33: ICT ..... the internal control system of an organisation	Weakens	2	0	2
	Neither Stregthens Nor Weakens	4	4	8
	Strengthens	27	18	45
	Greatly Strengthens	8	3	11
Total		41	25	66

Table F43